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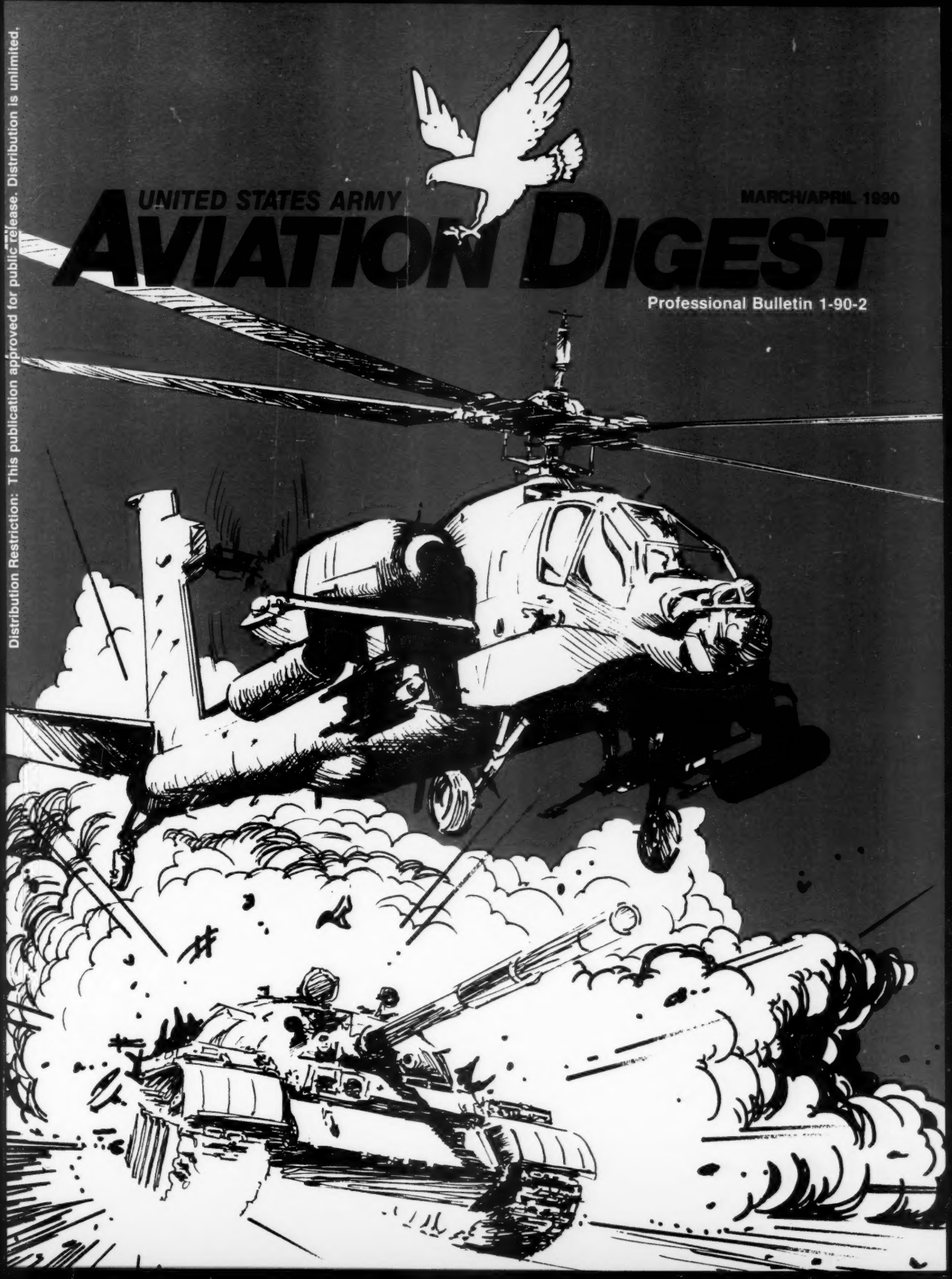
UNITED STATES ARMY

AVIATION DIGEST

MARCH/APRIL 1990

Professional Bulletin 1-90-2



AVIATION DIGEST

PROFESSIONAL BULLETIN

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Major General Rudolph Ostovich III
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Major General Rudolph Ostovich III
Chief, Army Aviation Branch

Aviation Doctrine, Tactics, Techniques and Procedures

ARMY AVIATION remains a capable force that, by its very nature, is sufficiently versatile to address changing national security requirements. Our branch has been and will continue to be a key member of our land forces. As a relevant and indispensable member of the combined arms team, there is a need to document our growth and include it in our publications that discuss our doctrine, tactics, techniques and procedures.

During the past 7 years, we have published several manuals that establish the doctrinal foundation for conducting a wide variety of aviation-related missions. **Doctrine** states the fundamental principles by which the military fights its forces. AirLand Battle doctrine (FM 100-5, *Operations*) certifies our existing Army doctrine and describes how we intend to employ our military forces. Army Aviation applies the tenets of AirLand Battle doctrine in its capstone manual, FM 1-100, *Doctrinal Principles for Army Aviation in Combat Operations*.

Tactics are the means by which commanders translate combat power into victory. They analyze mission, enemy, terrain, troops and time available (METT-T) to determine which methods will accomplish the mission. Many Army Aviation manuals begin with doctrinal employment information and then establish guidelines and checklists to help commanders and planners make the right tactical choices. Several current and future manuals follow this format: FM 1-111, *Aviation Brigades*; FM 1-112, *Attack Helicopter Battalion*; FM 1-114, *Regimental Aviation Squadron*; FM 1-116, *Air Cavalry/Reconnaissance Troop*; and FM 1-118, *Command Aviation Battalion/Company*.

To select the appropriate **technique**, commanders must further apply METT-T and emphasize their specific units' combat capabilities, limitations and equipment. The choice between a continuous attack as opposed to a phased attack is a technical one. The manuals previously listed contain generic information and checklists to help commanders and planners select techniques. Other manuals give more technical information and guidance: FM 1-101, *Aviation Battlefield Survivability*; FM 1-102, *Army Aviation in an NBC Environment*; FM 1-104, *Forward Arming and Refueling Points*; and FM 1-107, *Air Combat Operations*.

The exact action performed during a target handoff between a scout and an attack aircraft is a **procedure**. Procedures further define the "how to do" process. You will find them in manuals and in tactical standing operating procedures. All Army Aviation manuals are expanding to include more procedures.

This brings us to our new generation of literature. We have recently published white papers that combine doctrine, tactics and some techniques specific to an assigned mission. They include "Air Assault Security"; "Employment of the Target Acquisition Reconnaissance Platoon/Company"; "Diving Fire for Attack Helicopter Operations During Low Intensity Conflict"; and "The AH-64 and OH-58C Warfighting Tactics, Techniques and Procedures." We are also developing new literature to coincide with our changes in missions, equipment and force structure. These include documents on the armed OH-58D Kiowa Warrior and Army Aviation in counter-drug operations.

As you can see, Army Aviation is growing. As our branch matures, we gain experience, integrate new technology and adapt to new situations. We update existing documents and create new ones. We realize the importance of up-to-date field publications that have the practical touch of common sense and actual field experience.

When you have corrections or suggestions, please pass them to us. In turn, you can help us produce a better product. Make changes or recommendations on DA Form 2028. To request information or make comments, write to the Commander, USAAVNC, ATZQ-CAT-DD, Ft. Rucker, AL 36362, or call AUTOVON 558-4882/3947. Our continuous growth will ensure that we remain a relevant force for the future.

Moral Disruption by Maneuver

Captain Kevin B. Smith
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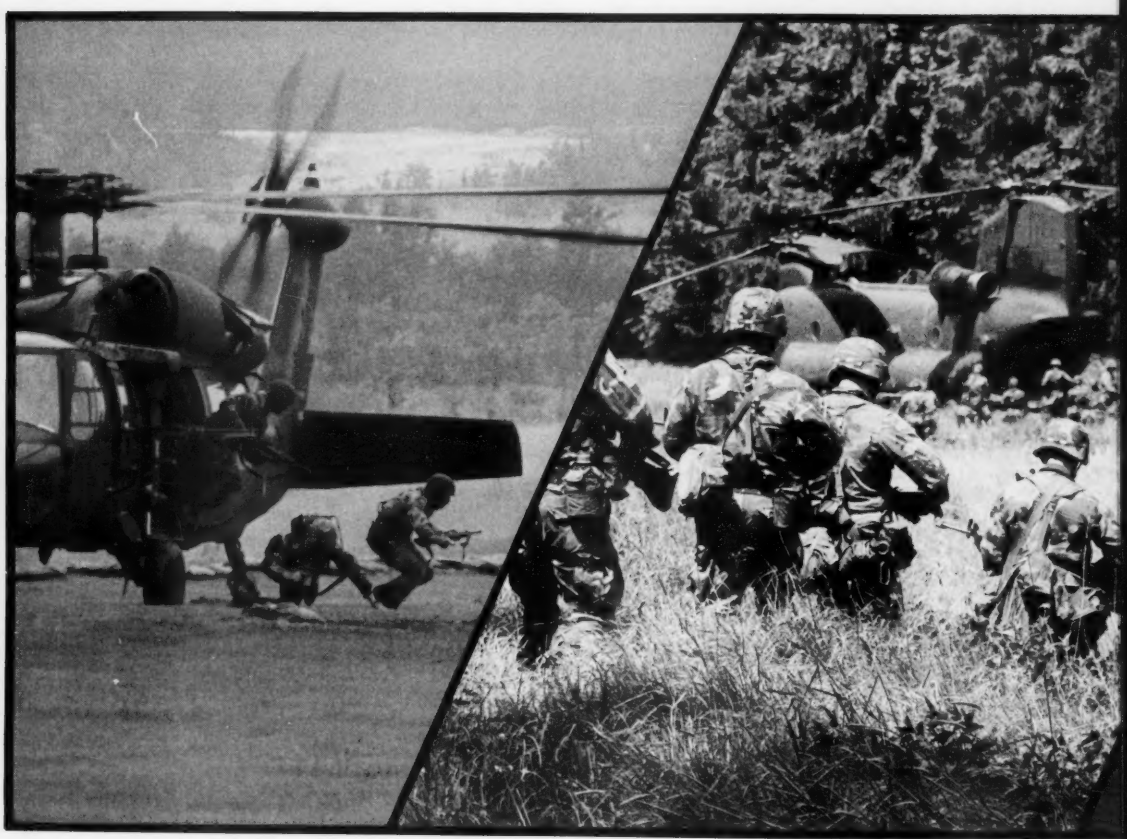
Can the "moral" force described by Colonel Ardant du Picq and General Karl von Clausewitz be an operating system?[1] Is the moral force a theoretical "black box" into which we can place measured input data and expect to gain a measured "psychological/moral" response?

Few models contend with the known, but impossible to quantify, fact that a



U.S. combat teams in action—their mission: Attack the enemy from the rear, disrupt their communications, seize strategically important roads and bridges and cause as much disruption, havoc and confusion as possible.

unit's true fighting power is a constantly changing combination of both a psychological/moral force (a la' du Picq) and the purely mathematical possibilities of weapons effects. Yet, despite the lack of supporting hard numbers, the moral force has always been, and remains, one of the most powerful forces on the battlefield—if not the most powerful.

TO COVER THE entire impact of psychological or morale factors on the fighting power of an army is virtually impossible. The field is much too broad. This article is, instead, a brief survey that supports and defines the phenomenon of moral disruption by maneuver. "Quoting the record" will, hopefully, keep us treading on the terra firma of the historian instead of slipping into the theoretical quicksands of the psychologist.[2] Regardless of the source, though, there is a legitimate need to know how, when or where to maneuver and shoot in order to generate confusion, panic and disruption on the modern battlefield far beyond the physical effects of our own weapons.

Tactical Styles of Warfighting

In a broad sense, two pure tactical styles of warfighting are generally recognized—*attrition* and *maneuver*. The attritionist measures victory or defeat by relative casualties suffered. This style is easy to simulate mathematically. Thus it drives many wargames by the application of such things as "Lanchester" equations.[3] The maneuver style, on the other hand, measures victory by relative disruption—prisoners of war (POWs), abandoned positions and psychological impact. These particular phenomena are seen as impossible to duplicate mathematically—so we don't.

COL John Boyd observed that "*...We do not have any models today that measure how you capture prisoners. They are all Pk or body count models or expected values, which are nothing more than an accumulation of body count. So if they cannot measure that phenomenon that generates*

1. "Moral force" is the term used by both du Picq and Clausewitz to describe the courage, daring and combativeness of a body of troops. The use of the word *moral*, in this article, has nothing to do with the concept of "right" or "wrong" as measured by religious or ethical standards.

2. Richard Holmes, *Acts Of War: The Behavior of Men in Battle* (New York: The Free Press, 1985), p. 15.

3. Lanchester equations attempt to predict battle outcomes by comparing relative strengths and resulting casualty rates.

Moral Disruption by Maneuver

prisoners...(then) any model we have...is attrition warfare."[4]

The first problem, therefore, is to determine which tactical style corresponds the closest with reality. Unfortunately, we cannot arrange a debate between the "king of ORSA" and General von Manstein.[5,6] As an alternative, however, the ORSA community recently revealed that *"No matter how casualties are measured, battles have been given up for lost when casualties ranged from insignificant to overwhelming.... Just as for troop casualties, no dominant pattern emerges from a study of equipment losses...the principle condition associated with defeat appears to have been the use of maneuver by an enemy (64% of 80 cases studied—auth).*"[7] While realizing that the absolutely pure style is rarely found, and that actual combat is always a mixture of maneuver and firepower, the historical facts appear to support the maneuver style of warfighting.

Impact of Maneuver

What is it about maneuver that causes the defeat of a force? The impact of maneuver has more to do with the mental apprehension of what might happen next than with the facts of what is physically happening now. In practice, this involves two particularly important components of operations—unit orientation and lines of communication (LOC).

It is generally recognized that a combat unit needs to point a majority of its weapons in the direction of the enemy. An enemy unit on the flank means that the linear defender cannot bring a majority of its weapons to bear. The "what might happen next" question creates a nearly unbearable mental pressure to reposition or reorient (or run).

Max Hastings noted that *"An uncertain and unhappy...infantry unit would be hustled into a defensive position.... The North Korean tanks would come forward until they met (the Americans).... Then they halted to allow infantry to swarm past them, infiltrating the...positions and working around their flanks. The (defenders) then withdrew, often in undignified haste....*"[8]

Lines of Communication

LOC are the delicate umbilicals from frontline to rear area. Always important, they are even more so now in mechanized armies that lack any great capacity to live off the land. *"Every western soldier is linked somehow or another with his rearward services; they bring him sustenance and comforts which make his life bearable.*"[9] The "what might happen next" question creates the real fear that a soldier will be denied proper medical care or sufficient food—not to mention the possibility of being captured, killed or tortured.

History is filled with countless examples of units falling apart after their LOC were only briefly cut: *"...the flimsiest rumor of the men in quilted jackets being observed on a main supply route behind the front was enough to spark fears of encirclement, and often outright panic.*"[10]

Unit Behavior

Nonlinear defense. On a nonlinear battlefield, however, there are examples of units who are organized in an all-around defense. These units may have been overwhelmed but, by definition, were impossible to outflank. In some of the successful cases, the LOC were kept open by air resupply. In other nonlinear cases, the unit may have realized that a severed LOC was an extremely transient event that would resolve itself within an estimatable (and therefore tolerable) period. A previous quote by Hastings described units that, initially, were failing to hold a linear defense. After a year of nonlinear fighting, these same units found that *"The key to tactical success...was to create all-around defensive perimeters, and not allow panic to set in when it was discovered, as it so frequently was, that the Communists had turned a unit's flank.*"[11]

Linear defense. Therefore, a subtle, but extremely significant, difference exists between linear and nonlinear unit behavior after the enemy has flanked or turned it. It may well be that units in a linear defense assume a sort of "unwritten mental contract." They will bring fire to bear to the front, and they expect the friendly units on each flank to do the same. An enemy on the flank or rear is

obvious proof that someone has not kept up his part of the bargain. S.L.A. Marshall commented that, if soldiers "*see a default (in support) anywhere, they feel this gives them a moral [ethical] excuse to default in their position.*"[12]

Sensitive unit boundary. We can draw dozens of similar examples from the pages of history, but the point is made. It leaves us with the notion that a combat unit in a linear battle has a peculiar sensitive boundary around it.[13] If an enemy approaches the unit from the front, this boundary should not be too sensitive since the enemy is usually expected from that direction. If approached from the flank, however, the unit is much more sensitive (usually) not only to the enemy, but to the actions of adjacent units as well.

At the La Fiere Bridgehead, Normandy, 9 June 1944, "*An infantry company commander gave an order for a limited withdrawal. But he was with the left flank platoon and the order didn't carry to his right flank (platoon). He then began an orderly but rapid withdrawal of the left flank (which) remained under control and stopped at the line designated. The right flank, seeing the movement but not understanding...promptly took to its heels.*"[14]

"Unit Moral Envelope"

Physical dimensions and size. The exact physical dimensions of this boundary, the unit moral envelope (UME), cannot be fixed since the impact of a host of variables will cause it to shrink or grow. The unit's morale and its physical state—the number of days without sleep, quality of the food, weather, results of recent battles, etc.—have a significant impact, causing a unit to hold on longer or break and run sooner. Thus, the size of an individual unit's UME fluctuates over time. Adjacent units holding the same position might have different UME dimensions. Consider the case of two German divisions, side-by-side, receiving identical attacks on the Eastern front:

"*...on our left was a division from the Moselle region. The chief of staff was a good friend of mine from staff school. In this division, as soon as a hundred Russians had appeared over the horizon, the first soldiers would already be fleeing. I asked my friend, 'What in blazes is wrong over there? Our men can see it—a hundred Russians doesn't mean you have to run!' (He replied) 'I am in despair because I can't change it; my commander is equally desperate. These people simply won't hold—they have some kind of fright in their bones.'*"[15]

Another case, during the Bulge, finds the flank guard battalion of a German division coming into fleeting contact with the remnants of an American infantry company. "*LTG Herman Fritz Bayerlein ...concludes that the heavy fire comes from American forces entering the village. Certain that he has been outflanked, he prepares to withdraw his center and recommends to the corps commander that the attack on Bastogne be suspended until he*

4. Colonel John R. Boyd, "Patterns of Conflict," presented during USAF Seminar "WARP XII," 18 May 1978, p. 32.

5. ORSA—Operations research and system analysis is a form of battle analysis that concentrates mainly on pure weapons performance and loss rates—it is a tool to study the attrition style of war.

6. General Erich von Manstein is regarded by many to be the best maneuver commander in the German Army of World War II.

7. Robert McQuie, "Battle Outcomes: Casualty Rates as a Measure of Defeat," *Army Magazine*, November 1987, p. 33.

8. Max Hastings, *The Korean War* (New York: Simon and Schuster, Inc., 1987), p. 78.

9. Major General F. W. von Mellinthin, *Panzer Battles* (New York: Ballentine Books, 1971), p. 363.

10. Hastings, p. 171.

11. Ibid., p. 171.

12. S.L.A. Marshall, *Men Against Fire: The Problem of Battle Command in Future War* (Gloucester, MA, Peter Smith, 1947), p. 191.

13. The concept of a unit being sensitive about its flanks or rear is nothing new. I have chosen to refer to a combination of both flanks and rear as a "sensitive area," or UME, to facilitate a more difficult discussion later in the article.

14. Marshall, pp. 146-147.

15. Lieutenant General Heinze Gaedke, translation of taped conversation by Battelle Columbus Laboratories, Columbus, OH, November 1979, pp. 32-33.

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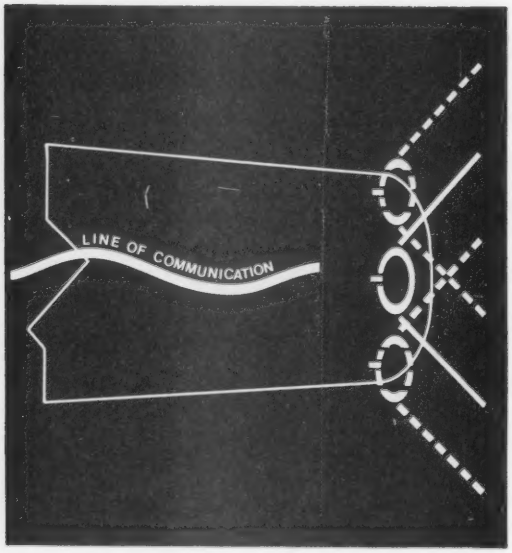
can extricate his division from an impossible position."[16]

These two examples illuminate another key idea—that the UME surrounds small units as well as large, thus having impact on the tactical as well as the operational level. An examination of Jackson's rout of Banks from Strasburg, the Egyptian panic after the 1973 Israeli counterattack across the Suez Canal (to name two), or any of a hundred counterattacks or counterstrokes on the Eastern front will confirm this idea. It is an idea as old as mankind itself—bad things happen when your enemy gets behind you.

An incursion, or predicted incursion, of an enemy inside the UME (or the unexpected retreat of a friendly adjacent unit) will cause a unit to do something. What this unit will usually do is to move away from the enemy and toward a more secure location in an effort to restore its UME. In many cases the unit LOC is seen as the most secure area. A majority of disrupted units will tend to move toward this area. In cases of severely disrupted units, *"...the survivors usually cluster around the field kitchen or baggage train to seek refuge and solace."*[17]

The figure below puts shape to the UME. A company-sized unit is depicted occupying a battle position in a linear defense. To the flanks are its adjacent units. Each unit has a sector of fire to cover. For the center company, a bell-shaped sensitive boundary starts immediately in front of the battle position. The boundary usually rests between the unit itself and the effective range of its weapons since *"To fight from a distance is instinctive in man. From the first day he has worked to this end, and he continues to do so. It was thought that with long range weapons close combat would return. On the contrary, troops keep getting further off before its effects."*[18] The envelope gets wider (more sensitive) at the flanks where the adjacent units are required to defend. Finally, the envelope extends rearward to include the company's LOC with its parent unit.

The unit moral envelope.



Creating Moral Disruption

As the flanked unit begins to move away from the enemy and toward the LOC, several unpleasant things normally happen: a retrograde, a retreat under pressure, panic-stricken flight or even surrender. For the attacker (or counterattacker), the acquisition of a position on the flanks or rear is only the means to the end for which we are striving—disruption of our opponent's morale. The worst thing to do, it seems, is to stop or become passive upon reaching this positional advantage, and allow the opponent to retreat with some semblance of order. One should continue just one more step and push him. The reaction of the flanked unit will then correspond to its perception of the enemy (and what the enemy might do next).

As we have seen, a unit could be so apprehensive that the mere rumor of an enemy on the flank or rear was enough to send men into flight. The enemy could have been a two-man detachment trying to surrender, but misperception through rumor, poor reporting or visceral fear caused the enemy on the flank to enlarge exponentially.

The probable root of this misperception is a combination of several factors. First, not only are

the weapons of a linear defense oriented to the front but also a considerable portion of the unit's "eyes" as well. Even with eyes to the front, a unit may still have a hard time defining the size of its enemy. As S.L.A. Marshall puts it—"*The nature of the terrain over which maneuver forces proceed toward engagement, the nature of protection, and the physical reaction to hostile fire all determine that (opposing) forces...remain largely invisible....*"[19] If one cannot identify the size of an enemy to the front, one surely cannot do it when the enemy is on the flank.

Second, the first reports of an unexpected and mobile enemy to the flanks and rear have a very poor "signal to noise ratio." The unit commander must correctly sort through what is accurate and what is not if he is to avoid a "*...potential gross error in 'reading' the battle.*"[20] This causes a command and control "lock up" for a finite period of time, which can have an extremely detrimental effect on soldiers' desperately waiting for someone to decide (and then tell them) what to do. It often becomes impossible to distinguish between an enemy platoon and a brigade before one's men disintegrate into a mob.

Understanding the UME, and the notion that its penetration by an enemy will cause the unit to "do something," our next step is to see how the previously mentioned misperception of the enemy has to work its obtuse psychology on the minds of only one or two soldiers to cause a wholesale panic:

"*...it can be laid down as a rule that nothing is more likely to collapse a line...in combat than the sight of a few of its number in full and unexplained flight to the rear. Precipitate motion in the wrong direction is an open invitation to disaster. That was how each of...seven incidents got its start. One or two men made a sudden run to the rear which others in the vicinity did not understand. For in every case the testimony of all witnesses clearly developed the fact that those who started (to) run...started the panic.*"[21]

We now, finally and completely, depart the attritionist's world of force ratio calculations. Little effort is needed to conclude that the result of a battle depends on the fearful imagination of the individual soldier under fire. Precisely at this point, the attacker must push the defender—just enough to cause the first soldiers to break and run. Magnify the misperception, or in the words of du Picq: "*...if I can frighten them, they will run away. I can shoot them and bayonet in the back. Let us make a try at it.*"[22] Make noise—make smoke. Bluff him. Strive to appear many times larger than the strength with which you arrived. Push him with that final ounce of synchronization that brings in that last bit of artillery as you appear.

Now is the time to jam the enemy's command net—lock up his command and control for those few critical moments when his soldiers need control the most. "*Make the enemy believe that support is lacking; ...cut off; flank, turn, in a thousand ways make his men believe themselves isolated.... The instinct of self-preservation which at the last moment dominates them utterly is not opposed by discipline.*"[23] The intent is not to kill, but to "*...shatter cohesion, produce paralysis, and bring about adversary collapse by generating confusion, disorder, panic and chaos.*"[24]

This is the essence of maneuver. It is not a new idea.

Generating a Mob

Instead of merely forcing the flanked unit to move away in good order toward his LOC, maneuver into an enemy's UME has the excellent poten-

16. Marshall, p. 92.

17. von Mellinthin, p. 353.

18. Colonel Ardant du Picq, *Battle Studies: Ancient and Modern Battle* (as republished in *Roots of Strategy, Book 2*, Harrisburg, PA: Stackpole Books, 1987), p. 138.

19. Marshall, p. 89.

20. Edward N. Luttwak, "The Operational Level of War," *International Security*, Winter 1980, p. 76.

21. Marshall, pp. 145-146.

22. du Picq, p. 172.

23. Ibid., p. 147.

24. Boyd, p. 35.

Moral Disruption by Maneuver

tial for generating a panic-stricken mob in flight. This idea of generating, and then "pushing," a mob must be addressed, since it represents the culmination of the maneuverist's art.

Mobs, or crowds, "*...are implicit in armies. Inside every army is a crowd struggling to get out, and the strongest fear with which every commander lives—stronger than his fear of defeat or even of mutiny—is that of his army reverting to a crowd through some error of his making....*"[25] The truth is that mobs have often formed in every army in history—even recent history, and even in the American Army.

The Flight Crowd

The maneuverist does not seek to generate just any crowd or mob in general, but the "flight crowd" in particular:

"*The flight crowd is created by a threat. Everyone flees; everyone is drawn along. The danger which threatens is the same for all...they feel the same excitement, and the excitement of some increases the energy of others...so long as they keep together they feel that the danger is distributed.... No one is going to assume that he, out of so many, will be the victim and, since the sole movement of the whole flight is towards salvation, each is convinced that he personally will attain it. Everyone who falls by the way acts as a spur to the others. Fate has overtaken him and exempted them ...the natural end of the flight is the attainment of the goal; once the crowd is in safety it dissolves.*"[26]

"Safety" to a flight crowd has meant different things at different times. In the 1800s, safety was probably sensed as the line of sight or direct fire was broken. In Korea, shattered defenders often moved until they could no longer hear the sound of machinegun fire. It follows, then, that to achieve the complete "moral" disintegration of the enemy, one must not only generate the initial panic—but also have some facility remaining for the pursuit, which prevents the flight crowd from reaching and then "dissolving in safety," and reestablishing a defense. Again, the concept of the UME rears its wobbly head since the pursuer must violate this *safety* boundary of the pursued to continue pushing.

Effective Pursuit

Effective pursuit not only prevents the establishment of a new defense but also inflicts casualties (physical and mental) far beyond simple weapons effects: "*...it was during the flight of those who broke that heavy casualties were inflicted, as the pursuers ran down their victims with a pitiless blood-lust that seems to overtake soldiers when they themselves are suddenly released from the danger of death...the vanquished who survived this physical experience, and the attendant 'panique terreur' as French professional soldiers would later characterize the emotional shock, were usually quite incapacitated from further action for a considerable time afterwards.*"[27]

Attitude of the Flight Crowd

Personal accounts of pursued soldiers are understandably few in number but so graphic that they cannot help but convey the attitude of the "flight crowd":

"*Never before, despite my capacity for fear, had I felt myself for so long in the grip of a terror so absolute. All around us was the continuing threat of instant death. Yet I saw no one fall...the company that night was in the grip of a sort of communal terror, a hundred men running like rabbits.*"[28]

"*All day for nine hours we ran. It was the contagion of bewilderment and fear and ignorance. Rumor spread at every halt, no man had orders. Everyone had some theory and no plan beyond the frantic desire to reach his unit.... In ourselves, we did not know what to do.*"[29]

The proponents of attrition would be hard pressed to explain how a handful of soldiers could drive thousands of the enemy before them like so many cattle. Yet the evidence is there:

"*Up the Veronica Causeway toward the San Cosme gate to the city they raced...driving the panicky Mexicans ahead of them by sheer audacity. (The future Confederate General Daniel Harvey) Hill experienced what he called 'a sublime and exalted feeling...chasing some five thousand men*

with little more than a dozen'...for more than a mile he and his men pursued alone."[30]

Pursuit

Pursuit is the final component in this process of disruption by maneuver. If force ratios mean little in a maneuver contest, they have absolutely no meaning in the pursuit. Pursuit, however, can be a two-edged sword. Commanders often have made the error of chasing a routed enemy too far. There comes, as with all things, a culminating point, however brief. Horses become "blown," tanks run out of gas and men reach their limit of endurance. The pursuit must stop before the pursuer, himself, reaches this culmination point, or he will run the risk of becoming the pursued.

The charge of the Union Brigade against d'Erlon's corps at Waterloo is a classic case of pursuit gone way too far. d'Erlon's corps was routed, but the Union Brigade continued to pursue for less than a kilometer across muddy fields until, exhausted, they found themselves directly in front of the French lines—and the canister rounds of the grand battery.

Summary

Moral disruption through maneuver is a process having much more to do with doubt, or fear, or crowd psychology than with the effects of any particular weapon or arm. To summarize, the process usually flows through these steps:

- An undisclosed movement to the flank or rear of an enemy.
- The unexpected appearance of a poorly defined enemy within the UME.
- The application of force (or bluff) sufficient to cause the first soldiers to break and run. Artillery, smoke, jamming, multiple routes, or a rapid surge of direct fires can help to make the attacker appear many times larger.
- The detection of the initial disintegration and the quick "push" to cause a precipitous failure of morale local to the initial disruption.
- The beginning of a pursuit that manages to continually violate the pursued unit's UME.
- The successful sustainment of the pursuit, or the decision to end pursuit before the "culminating point."

Having defined the chronological sequence of events in a 'moral disruption by maneuver,' I should remind the reader that this is a process of the human mind and, therefore, cannot carry the force of a physical law.

Caveats

First. "The unexpectedness of an event accentuates it, be it pleasant or terrible. This is nowhere seen better than in war, where surprise terrorizes even the strongest."[31] It is always necessary to possess some degree of surprise to disrupt by maneuver. If the maneuver into the flank or rear proceeds too slowly and is detected, the enemy has the opportunity to change unit orientation, thus reorienting the UME as well. Speed and relative surprise go hand in hand.

Second. The cases where units have broken and run occur most frequently in new units or during the first battles of a war—green soldiers and green leaders. Something in a combat unit's learning curve makes it harder to disrupt over time.

Third. During meeting engagements, two opposing units often may end up violating each other's UMEs simultaneously. In these cases, the unit with the weaker will (or larger UME) will usually break first. This point is critical in any discussion of deep battle. A unit that is striking across the forward line of own troops[32] must accept the fact that its own UME will be violated continually and steel itself to make the enemy break and run first.

This "power of the stronger will"[33] was probably a key ingredient of countless German small-unit

25. John Keegan, *The Face of Battle* (London: Jonathan Cape, 1976), p. 173.

26. Elias Canetti, *Crowds and Power* (Gollancz, 1962).

27. John Keegan and Richard Holmes, *Soldiers: A History of Men in Battle* (London: Hamish Hamilton, 1985), p. 24.

28. Holmes, p. 226.

29. Keegan and Holmes, p. 42.

30. Hal Bridges, *Lee's Maverick General* (New York: McGraw-Hill Book Co., Inc.), p. 21.

31. Xenophon.

32. FLOT—forward line of own troops.

33. Also referred to as the "longer breath" by Lieutenant General Lothan Rendulic.

counterattacks, especially on the Eastern Front. Although heavily outnumbered, recalls LTG von Mellinthin, "*we always felt superior to them—we were not afraid of them.*"[34]

Small groups of well-trained, offensive-minded soldiers who possessed the "power of the stronger will" could win battles merely by reputation:

"*Wherever Stuart rides he carries terror with him. His victories are half won before he strikes a blow. Our soldiers feel that he may pounce upon them at any minute...Stuart wanted his men to believe in themselves; he wanted his enemies to become accustomed to defeat at his hands and get used to running from his horsemen.*"[35]

Fourth. Armies trained on linear tactics almost always fare poorly against an enemy that uses breakthrough or infiltration. Linear tactics, attrition through firepower and terrain-oriented missions are all terms that are guilty by association. Nonlinear tactics, moral disruption, and force-oriented missions are the palette of the "maneuverist."

Fifth. Disruptive maneuver into an enemy UME can generate outright passivity (as well as panic). In these cases, the enemy prisoner count can exceed the casualty count by whole orders of magnitude. The disruptive maneuver of Wehrmacht 'blitzkrieg' elements, slicing through Polish, Czech or French UMEs, generated 2,000,000 prisoners and 300,000 casualties (a ratio of about 7 to 1). Whole brigades simply gave up. The excessive casualties of the effectively pursued, and the masses in the POW cages, have absolutely nothing to do with the attritionist's Lanchester equations. Since maneuver is the predominant cause of a unit's defeat, we must create some means of realistically duplicating maneuver's effects. Only then can we institutionalize the concept of 'morally disruptive' maneuver in our doctrine and training.

Sixth. Many (if not most) military operations hover dangerously on the brink of disruption without any enemy interference whatsoever: "*...disruption has historically not been necessarily the result of hostile threats or action alone...disruption within a military force can be created by actions—or inactions—of individuals or groups within that force, resulting from incompetence, oversight, misunderstanding, or even treachery.*"[36] We do not have to scratch the surface of history deeply to discover many, many examples of units that have simply disrupted themselves. Disruption can be made to work for you—or you may be the unfortunate victim. It is a moral sword that most certainly cuts both ways.

The notion of violating a UME through maneuver—and then disrupting the enemy's morale—applies throughout the entire warfighting spectrum. We must keep in mind that it can happen to us as easily as to the enemy. It can be used to help understand the dynamics of defensive unit disintegration after forced or "soft spot" breakthroughs, or infiltration. Within FM 100-5, *Operations*, and its emphasis on the offensive-defense, the concept of the UME can help guide the counterattacker to the place where he can do the most harm to a larger enemy.

Conclusion

Moral disruption through maneuver is clearly a repetitive phenomenon, occurring in each war and within each army. It should, therefore, lend itself to some model or theory; however, no usable theory exists. It should be taught, in depth, to junior officers of the combat arms. Yet, the young lieutenant today learns more of disruption of morale in one evening of television than he does in his entire service schooling.

Moral disruption through maneuver did not vanish with the fielding of the M1 tank or the AH-64 Apache. It will remain a decisive element of combat until computers, which are void of emotion, replace man as the decision maker.

34. BDM Corporation, *Generals Balck and von Mellenthin on Tactics: Implications for NATO Military Doctrine*. Unpublished report for the Office of the Secretary of Defense, dated 19 December 1980, p. I6.

35. Emory M. Thomas, *Bold Dragoon, The Life of J.E.B. Stuart* (New York: Harper and Row, 1986), p. 172.

36. Historic Evaluation and Research Organization, *Disruption in Combat*. Unpublished Report for U.S. Air Force, dated 15 February 1970, p. 226.

Captain Walter M. Golden Jr. and Captain Chris Lusk
Headquarters, 4th Squadron, 9th Cavalry Regiment
6th Infantry Division (Light)
Fort Wainwright, AK

illustration by Paul Fretts

ARCTIC JAAT

VICTORY ON the modern battlefield will be won by air and land forces fighting together. In Alaska (AK), frequent joint air attack team (JAAT) training facilitates this objective. JAAT training provides the ground commander with a highly mobile, extremely lethal, tank killing force capable of engaging enemy forces beyond the range of other antitank weapons. The 4th Squadron, 9th Cavalry Regiment, 6th Infantry Division (Light), Ft. Wainwright, AK; and the 18th Tactical Fighter Squadron, Eielson Air Force Base, AK, share a unique training relationship. Aided by 28 miles of geographic separation between units and large training areas unequalled in continental United States or much of the world, JAAT training is conducted on a regular basis (see figure, page 12).

Ground force commanders marshal Army and Air Force assets and the following available mock training resources are used to destroy high-priority, lucrative targets:

- An airfield, tank and military vehicle bodies.
- Plywood armor, air defense, and communication jamming equipment.

Arctic considerations. The harsh arctic environment can have an adverse impact on aviation operations unless planned for in detail. It is common to conduct missions in temperatures around -20 degrees centigrade (C). At least once per season, the thermometer will register -40 degrees C.

ARMY

UNIT	ASSETS	FUNCTION	ORDNANCE/WEAPON DESCRIPTION
4-9 Cavalry Squadron	AH-1S	Provide aerial firepower	TOW missiles/2.75-inch rockets; 40 mm grenades/7.62 mm minigun
	OH-58A	Air mission commander	None
4-11 and 5-11 Field Artillery	105 mm howitzers	Provide indirect firepower	High explosive/variable time smoke, illumination
	Ground located laser designator	Provides aiming cue on heads up display for the A-10 aircraft	Class IV laser

AIR FORCE

UNIT	ASSETS	FUNCTION	ORDNANCE/WEAPON DESCRIPTION
18th Tactical Fighter Squadron	A-10	Provides aerial firepower	30 mm Gatling gun with armor piercing incendiary high explosive incendiary; MK-84 (2,000 pound general purpose bomb); cluster bomb units with MK-20 Rockeye, shaped charge, or MK-58, fragmentation/incendiary AGM-65 Maverick missile with television seeker or infrared seeker
343d Tactical Air Support Squadron	OV-10	Forward air controller	2.75-inch rockets

JAAT participants in Alaska.

Factor in wind chill, and at times the name of the game rapidly becomes survival. In extreme cold temperatures, the following tips are helpful:

- It takes two to three times as long to do the simplest of tasks.
- Aircraft batteries should be kept in a warm area when temperatures are below -20 degrees C. This prevents voltage drain and the resulting possibility of insufficient power for start or worse, a hot start. Aircraft require 15 minutes or more to warm up. During this time, flight control movement must be minimized and avionics should not be channelized.
- Maintenance problems will increase dramatically. The stabilization control amplification system on the AH-1 Cobra and avionics across the board (but particularly the AN/ARC-114 series field manuals) are adversely affected. Lubricant, arctic weight or break-free lubricants are required to solve the M-28 turret system problems on the modernized AH-1S Cobra.
- Static electricity is intensified and results in the requirement to cold refuel below -18 degrees C. Forward arming and refueling point personnel must heighten their safety awareness. Safety precautions are required during rearming operations especially when handling 2.75-inch rockets. Wind chill from rotor wash, and the associated frost bite danger, mandate cold rearming.

Snow. Blowing-snow operations are conducted from October through April in Alaska. We have discovered that AN/AVS-6 night vision goggles intensify light so much that blowing snow causes white-out conditions. At these times, the landing light or AN/PVS-5s are better for these approaches. Another snow-related consideration is that hovering AH-1 aircraft near snow cause a significant signature that can be seen for several kilometers. Depending on the situation, it may be better to conduct running fire to reduce the signature.

Ice fog. Ice fog occurs when cold air can't hold the water vapor caused by aircraft exhaust and other sources. Compounded by a surface inversion, the cold air and accompanying fog stay from the surface to about 200 feet above the ground. Ice fog

causes instrument flight rules conditions and may give attacking ground forces the advantage. Ice fog was created with the aircraft during JAAT training and running fire was used to maintain visual contact with the targets.

Survival gear. Aircrews must wear arctic issue flight gear in the cockpit. Also mittens and muklucks must be worn in temperatures below -30 degrees C in the OH-58 Kiowa and some AH-1 helicopters. In addition, each crewmember must carry 35 pounds of individual survival gear. AH-1 pilots must depend on scouts for this equipment when the aircraft are armed. A downed crew is always in a survival situation in Alaska, whether it is summer or winter.

Training scenario. At least quarterly, more often as ammunition allows, joint live fire exercises are conducted. These exercises reinforce and add realism to JAAT training. A typical scenario involves an infantry battalion conducting a night offense and day defense against a mechanized battalion or regimental sized threat. The ground commander is responsible for overall coordination of the operation. The air mission commander (AMC) executes the JAAT mission. Conditions include blowing snow, extreme subzero temperatures and rugged mountainous terrain. The standard is the synchronization of available artillery, attack helicopter and A-10 Warthog fires by the AMC.

Mission execution. The mission is initiated with the identification of the enemy armor or mechanized force. Once identified, the artillery with the TOW missile and/or 2.75-inch folding fin aerial rocket fire from attack helicopters, suppression of enemy air defense (SEAD) is accomplished. The AMC briefs the A-10 flight lead or airborne forward air controller on the following:

- Target location and description.
- Heading and distance from initial point to target.
- Air defense artillery air threat and method of suppression.
- Position and activity of attack helicopters and artillery.
- Friendly locations.
- Restrictions such as the artillery gun target line.
- Any additional information inbound calls require.

Immediately upon execution of the SEAD mission, the A-10s are sequenced into the attack with immediate reattacks. Doing this ensures that continuous pressure on the enemy is maintained. Attack helicopters cover the ingress and egress of the A-10s with organic fires. Coupled with 105 mm artillery fire, which the aeroscouts adjust, the JAAT offers the ground commander a high volume of lethal firepower. Firepower reinforces the ground commander's defense, negates enemy attacks and supports his offensive scheme of maneuver.

Sustainment. Sustained operations require continuous pressure on the enemy. A-10s and attack helicopters departing the target area update inbound flights and teams through the AMC. The AMC remains in the target area as long as possible to facilitate target hand-over to inbound flights and teams. The JAAT operation is sustained as long as assets are available or until the mission is accomplished. The AMC then effects battle hand-over to the ground commander.

Debriefing. At the completion of the exercise, a detailed debriefing is conducted with Army ground forces, artillery, aviation and the Air Force. The scenario, sequence of events and target effects are discussed and analyzed. Strengths and weaknesses of coordination and fire control are identified, and methods of improvement are suggested. In the final analysis all players agree, whether preplanned or spontaneous, JAAT training offers practical, realistic and coordinated training for Army and Air Force players.

Future operations. JAAT operations in Alaska are highly refined in the low- to mid-intensity opposing force (OPFOR) environment. Frequent training with Air Force elements has resulted in our AMCs being trained in controlling all aspects of the fight. Also, AMCs are intimately familiar with the A-10 pilots' language and their capabilities and limitations. Currently, communications jamming on all frequencies and static tactical radar threat generators (TRTGs) are used for training. A mobile threat array, mobile TRTGs and multiple integrated laser engagement systems will be used to continue improving tactics. Only with a realistic OPFOR will we really be able to measure our abilities. JAAT in Alaska is alive and well and will only get better in the future. *Arctic light.*

Computing heading and distance between two sets of grid coordinates is easy when you apply the methods described by the author.

AVOIDING THE ZIGZAG MONSTER

THE OTHER DAY, while flying around area of operations Vanguard, something that one of my students did really caught my attention. The scenario was as follows: It was late in the afternoon, near dark. We had been practicing terrain flight navigation using a 1:50,000 map with an Australian fold. In the vicinity of landing zone Glenda (EK 2395) I issued a mission change—"Climb to 800 feet and take me to Battens Crossroads, AL" (around EK 9457). For the next 20 minutes, I watched and listened as the student zigzagged us back to Battens Crossroads. We started off on a 170 heading and finally arrived on a 080 heading.

The reason we did not fly a direct route was because of the limitations placed upon the student by the size of the map. He had no way of computing heading and distance between the two points because they were not on the same map page. Then it occurred to me that this was typical of almost every Army aviator I had ever flown with no matter what the experience level.

For example, let us say that you are flying in support of a general officer and your mission is to visit several tactical operations centers (TOCs) today. Last night you had the coordinates of each TOC and planned your mission well. If you have an Australian fold map, you probably spent some time in flight operations in front of the big map posted on the wall to get your headings and distances. If you have separate map sheets, you probably laid them out on your living room floor, lining them up ever so diligently. Then you found the longest straightedge you could find to draw your course lines and found your distances and headings for this mission.

Now, during the execution of the mission, the general's aide approaches your aircraft at the first TOC and informs you that there was a night move last night. Then he hands you a piece of paper with the new coordinates to which you will fly. The general then jumps on board and, unless you have Doppler or inertial navigation systems, you proceed to zigzag to the new coordinates. In my opinion, this gives an unprofessional appearance. Your passenger is not fooled. He knows that you are "swagging" your course. Also, he soon learns that you swagged your estimated time en route (ETE) when you arrive 5 to 10 minutes earlier or later than scheduled. Of course, you could always blame the winds. Right? Here is an easy way to compute, from the cockpit, the distance and heading between two sets of grid coordinates. After you've practiced it a time or two, you will be able to complete the figures in less than 1 minute. In the scenario I described earlier, you wanted to fly from EK 2395 to EK 9457. The first step is to draw

CW3 Ron Toth
Company D, 1-212th Aviation Regiment
U.S. Army Aviation Center
Fort Rucker, AL

a course line. You should be able to tell from the coordinates that your destination is somewhere to the southeast of your position. Draw the course line accordingly, as in figure 1.

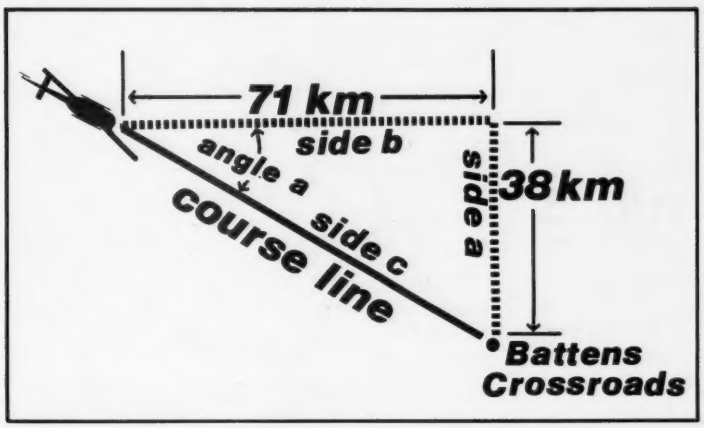
Next, fill in the sides of an imaginary right triangle as illustrated. After you have drawn your right triangle, fill in the length of each side by subtracting the appropriate numbers in your grid coordinates. In this case, the east/west difference between your position and Battens Crossroads is 71 kilometers (km) (EK 23** and EK 94**). The north/south difference is 38 km (EK **95 and EK **57). Now you can easily compute the distance between our aircraft and Battens Crossroads by using $a^2 + b^2 = c^2$ or $38^{(2)} + 71^{(2)} = 6{,}485$. Push your scientific calculator's square root button and you find that the distance is about 80.53 km. If you are travelling at about 90 knots (kt), you simply divide 80.53 by 2.78 (the number of km travelled in 1 minute at 90 kt) to find our ETE. In this case, it will take us almost exactly 29 minutes.

Next, you want to compute your heading. Because **side b** runs east/west or 090 and 270, if you compute how many degrees **angle a** has you can determine your true heading by adding that angle to 090. The formula to use is:

side a/side b = tan **angle a.**

It is simpler than it looks. You take **side a** (38 km), divide it by **side b** (71 km). The result is .5352112. Next, hit the "INV" button on your calculator followed by the "tan" (tangent) but-

FIGURE 1: Use of grid coordinates to compute heading and distance.



ton. The result is **angle a**—in this case, about 28 degrees. Our heading from EK 2395 to EK 9457 is 118 degrees true (090 degrees + 28 degrees). Last, add or subtract your magnetic variation and you are on your way!

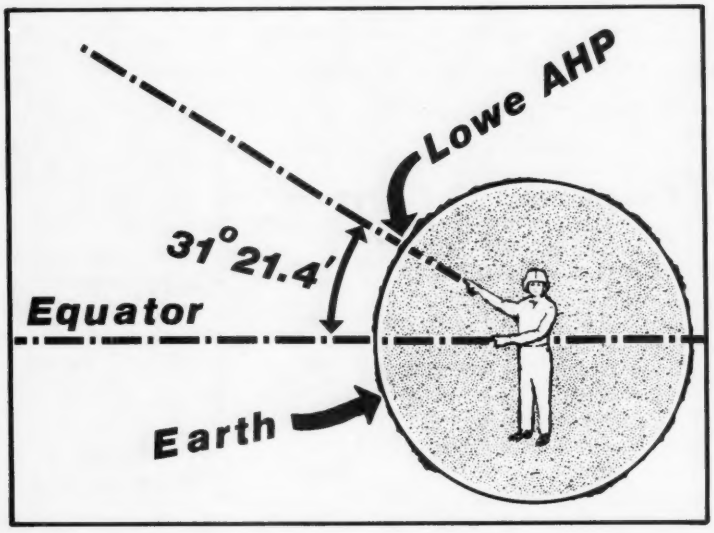
If you are passing between several grid zone identifiers, let's say from grid EK to EL, it may be easier to use latitude and longitude in your computations as described below. I used this method in Europe on a daily basis, and it is a better method for the longer haul.

Here is another scenario—what would you do? You are waiting to pick up a civilian dignitary in Wurzburg, Germany, and take him and his party to Garmisch for the evening. Five minutes before takeoff one of the civilian's aides gives you a note that says they must get to Brussels, Belgium, as soon as possible. Two of the first questions in your mind, other than clearances, etc., might be, "What is the heading?" and "Do I have enough fuel to get there?"

If you have no way of finding these answers from the cockpit, you may be forced to stop en route somewhere that is not exactly on the way to ensure, in your own mind, that you can complete the mission. If this means cold refuel, it may mean an unnecessary delay for your passengers. You must have the means to compute these things from the cockpit before you leave.

To use latitude and longitude effectively, you must know a little bit about them. Let us say that you are starting a cross-country flight from Lowe Army Heliport (AHP), AL. You can look in the instrument flight rules supplement to find that Lowe is at 31 degrees, 21.4 minutes north latitude, and 85 degrees, 44.9 minutes west longitude. Let me explain what these coordinates mean. First, both latitude and longitude refer to angles measured at the center of the earth.

FIGURE 2: Latitude is an imaginary angle from the center of the earth.



For latitude, if I were standing at the center of the earth, and my left arm, extended, were pointing at the equator, and my right arm were pointing to Lowe AHP, the angle measured at my torso between my arms would be 31 degrees, 21.4 minutes (figure 2). Keep in mind that 60 minutes make up 1 degree. Therefore, if I were to move north of Lowe exactly 38.6 minutes, I would be at 32 degrees north latitude ("north" merely refers to what hemisphere you are in). The nice thing about latitude is that no matter where you are on earth, 1 minute of latitude is equal to 1 nautical mile (nm). So again, if we were to move exactly 38.6 minutes north of Lowe, we would

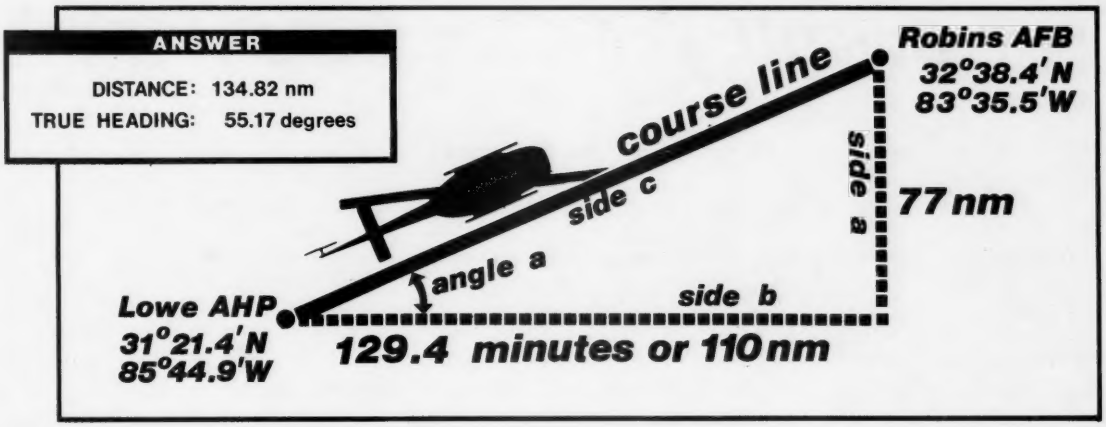


Figure 3: Use of latitude and longitude to compute heading and distance.

be exactly 38.6 nautical miles north of Lowe.

Longitude is measured the same way. If I were at the center of the earth, and my left arm, extended, were pointing to the prime meridian (not the equator), my right arm, extended, pointing to Lowe AHP, the angle formed between my arms at my torso would be 85 degrees, 44.9 minutes. The distance between 1 minute of longitude varies from 1 nm at the equator, to zero at the North or South Pole.

Now that we know more about latitude and longitude, we can plan a cross-country flight. Let us plan on going from Lowe AHP to Robins Air Force Base, GA. The coordinates for Robins are 32 degrees, 38.4 minutes north latitude, and 83 degrees, 35.5 minutes west longitude. We should be able to see from looking at the coordinates that Robins is north and east of Lowe. Draw our course line as in figure 3. Again, fill in the sides of your right triangle as shown, and post the length of each side in minutes. That would be 32 degrees, 38.4 minutes north, minus 31 degrees, 21.4 minutes north, which would equal 77 minutes. Also, 85 degrees, 44.9 minutes west, minus 83 degrees, 35.5 minutes west would equal 129.4 minutes. All we are doing is taking the smaller coordinate from the larger coordinate, keeping in mind that 60 minutes comprise 1 degree.

Before we use the formulas for computing headings and distance, we must first convert 129.4 minutes of longitude to nautical miles. Again, the distance between minutes of longitude depends on your position on the earth. To do the conversion, you take your minutes of longitude and multiply them by the cosine of your line of latitude. Huh? It is simple. Punch in 31 degrees, 21.4 minutes to your calculator (31.214) and push the "cos" button. Then multiply that number by 129.4. Your answer is 110.67 nm. Now you may use the same formulas mentioned at the beginning of the article to find your distance and heading.

It all looks complicated at first glance, but if you work through it just twice, you will see how easy it is. Whether you are using grid coordinates or latitude and longitude, you can accurately compute headings and distances between any two points from your cockpit in less than 1 minute. It just takes the use of a scientific calculator (less than $15 in most stores) and a little practice.

A Cockpit We Can Live With

This is the second in a series of articles on human factors considerations that will appear in the Aviation Digest in 1990. The inflatable body and head restraint system is yet another development in the man-machine interface of cockpit design to further reduce aviator injuries.

SINCE THE introduction of rotorcraft in the 1950s, the U.S. Army has made great strides in helicopter crashworthiness. The UH-60A Black Hawk and the AH-64 Apache have achieved unprecedented levels of crash safety through use of energy absorbing landing gear, crushable fuselage structure, crashworthy seats and many other design features.

These improved energy absorbers help to control peak loads and dissipate the huge amounts of crash energy involved. However, the energy absorbers do little to prevent movement of aviators within their restraints. This movement is substantial in high-energy, survivable crashes and results in secondary impacts to objects within the cockpit that may be serious or fatal. The AH-64's optical relay tube (ORT), located in the forward cockpit, incorporates a load link designed to collapse the ORT at about 300 pounds of load. In spite of this, injuries occur because of its close proximity to the aviator's head and the impact loads involved in accelerating the significant mass of the ORT once contact is made.

Statistically, about two-thirds of the major and fatal cockpit injuries in survivable mishaps are due to secondary impacts to the head and upper torso.

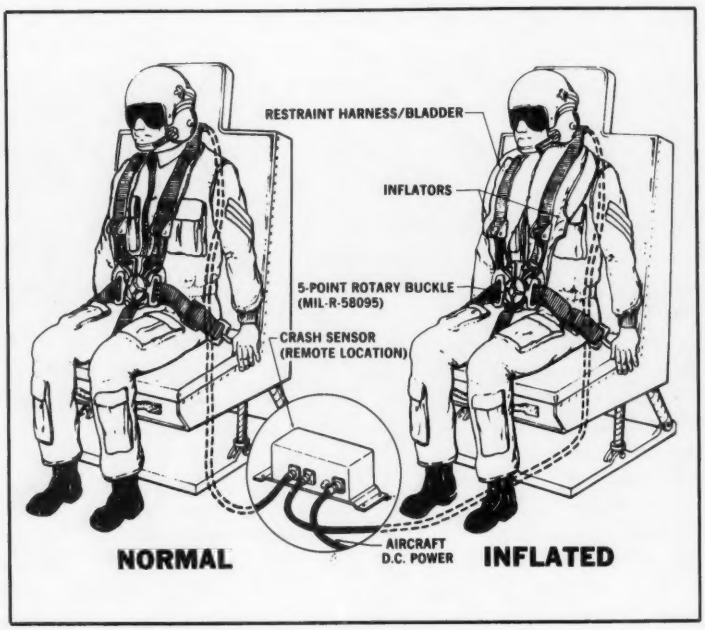


FIGURE 1: Inflatable body and head restraint system.

The Aviation Applied Technology Directorate (AATD), Ft. Eustis, VA, a part of the U.S. Army Aviation Systems Command (AVSCOM), has conducted several research efforts to improve this situation for Army avi-

MONTHLY WRITING AWARD

Mr. Kent F. Smith
Aerospace Engineer
Aviation Applied Technology Directorate
U.S. Army Aviation Research
and Technology Activity (AVSCOM)
Fort Eustis, VA

FIGURE 2: The flailed position of a human cadaver seated in a UH-60A crewseat when subjected to a severe, but survivable, crash impact.

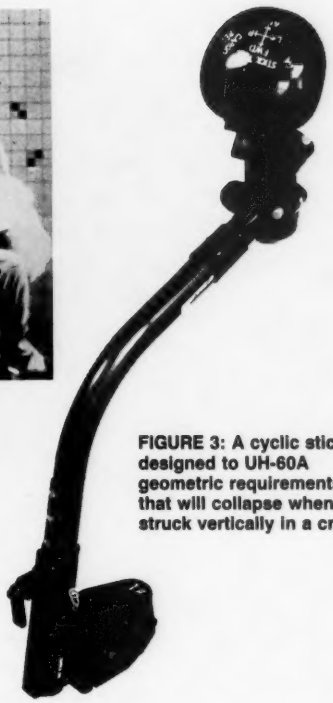


FIGURE 3: A cyclic stick, designed to UH-60A geometric requirements, that will collapse when struck vertically in a crash.

ators. The inflatable body and head restraint system (IBAHRS) was codeveloped by the Army and the Navy. This device is an airbag system sewn into a conventional five-point restraint and triggered to inflate by a remote crash acceleration sensor during the initial milliseconds of a severe crash (figure 1). This action instantly removes any slack in the restraint, distributes the crash loads more evenly about the upper torso and greatly reduces the reactive distance of the head and upper torso (strike envelope). The IBAHRS, now in engineering development, is scheduled for fielding in the AH-1 Cobra fleet starting September 1993.

Apparently, the cyclic control stick is a cockpit strike hazard that has lethal potential. In fact, the Army's first female aviator fatality was due to a cyclic stick strike to the head in an otherwise survivable UH-1 Huey mishap. Figure 2 shows the flailed position of a human cadaver seated in a UH-60A crewseat when subjected to a severe, but survivable, crash impact. The inertia reel was locked before the test. The head position confirms that, had a cyclic stick been present, a facial strike would have been inevitable. AATD initiated a program to design and fabricate a cyclic stick assembly that collapses when struck vertically in a crash. Figure 3 shows such a stick designed to UH-60A geometric requirements. The grip has a high-density foam pad bonded on top to distribute loads. The base of the stick is a

dovetail assembly with needle bearings and a small wire-bender energy absorber. The stick begins to yield under a 100-pound vertical impact load and will separate from its base near the floor after 2 inches of travel. Full-scale dynamic tests showed the design reduced dynamic impact loads by 78 percent compared to the production UH-60A design, placing it into the nonlethal load category.

Prototypes also offer a +/- 2-inch grip height adjustment via a cam/pin mechanism. This design will soon undergo flight evaluation by the Army and the Navy to determine pilot acceptance and long-term durability.

As the Army looks to the future, cockpits appear to be shrinking in size with more and more equipment mounted on the helmet because of various requirements; e.g., night vision, chemical or biological protection, and helmet sights. This loading up of the helmet effectively makes the head a large pendulum cantilevering from the upper spine and, coupled with a shrinking cockpit, it is not a bright picture for reducing cockpit secondary strikes. Consequently, AATD recently initiated a contract effort to devise innovations to further delethalize the future Army cockpit.

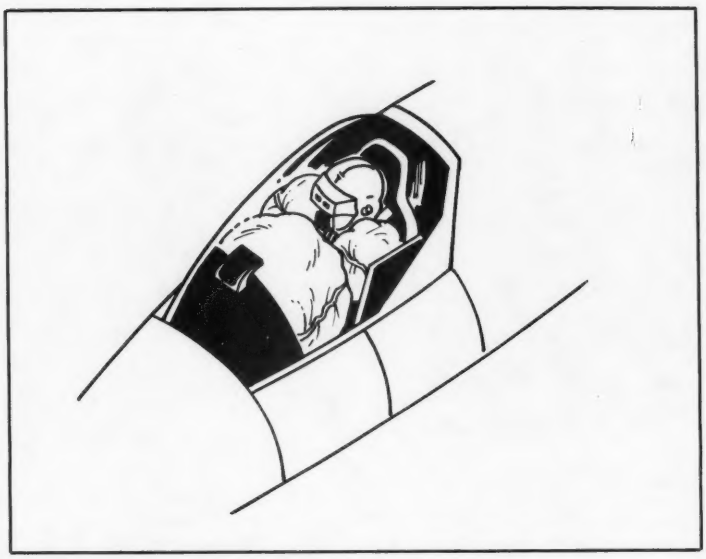
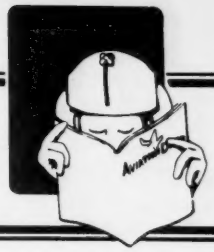


FIGURE 4: Airbag application to attack helicopter cockpit.

The program will examine passive measures, such as improved padding and unique frangible mounts, as well as active measures like automotive airbags in the cockpit. Figure 4 is a sketch of a cockpit that has three airbags—one within the main instrument panel and one on each armored wing panel of the crewseat. The idea is to totally encapsulate the aviator's head and upper torso before and during a severe crash pulse.

Where cockpit designs are headed is open to debate. Irrespective of the outcome, one of the AATD's missions will remain to maximize the Army aviator's chances for crash survival.

VIEWS FROM READERS



Editor:

Request the following notice be run in the *Aviation Digest*:

Attention UH-60 Black Hawk pilots! The U.S. Army Aeromedical Research Laboratory is in need of aviator subjects to participate in ongoing research. Currently, we need aviators between the ages of 21 and 40 with 20/20 vision, on flight status with a current flight physical. If 10 UH-60 simulator flight hours in 2 weeks would interest you, contact the USAARL aviator representative at AUTOVON 558-6864.

CPT Michael H. Hulsey
Adjutant
U.S. Army Aeromedical
Research Laboratory
Ft. Rucker, AL

Editor:

The September-October 1989 issue of the *U.S. Army Aviation Digest* arrived this afternoon.

I do have a special reason for writing you. The article "Eagles, Wings and Other Things," page 30, has what many of us, who were early in Army Aviation, would consider a major flaw.

The date 6 June 1942 is *supposed* to be the birthday of modern day Army Aviation. On that date, the then equivalent of Department of the Army (War Department) authorized creation of Organic (integrated) Army Aviation for the combat arms, Engineers and Signal Corps (as differentiated from the Army Air Corps/Forces). Officers and enlisted men with private pilot licenses were asked to join this new program.

I volunteered and was accepted into the 2d Liaison Pilot Class (P-2) in mid-August 1942, at Ft. Sill, OK. My class graduated on 2 October 1942. A major part of the class with a few from P-1 and P-3 went almost immediately to the landings in North Africa. I sailed from New York harbor on 15 October 1942, along with nine others; four more flew off the U.S.S. *Ranger* in the landings at Fedala and Casablanca with General Patton's Western Task Force. We landed across treadway bridging over sunken ships and picked up our aircraft at Casas Airport later.

The point is, none of us had been authorized to wear wings at all. After I got to Sidi-bel-Abbès, Algeria (home of the French Foreign Legion), in December 1942, some of the newcomers showed us their new "L Pilot" wings.

I had some British silver coins I'd accidentally brought back from Gibraltar. We went to a French jeweler in Sidi-bel-Abbès, who melted the silver and cast us our first wings! COL Mike Strok (Retired), P-3, will remember this.

In January 1943, several of us got a very nice surprise. The Army paymaster paid us back flying pay for the period 2 October 1942 to 31 January 1943. Apparently, someone couldn't stand for us to be flying and not drawing flying pay—although we had never been promised or even considered being *paid* to fly.

We had about 4,000 Army aviators in World War II and still had about 800 when the war in Korea started. Our next buildup started from there. I was at Ft. Monroe, VA, in research and development, 1950 to 1953, and got my first present day Senior Army Aviator badge about 1951. So, there were quite a bunch of us who wore "L Pilot" wings for a number of years. I don't find the badge or mention of it in your article!

Don't feel bad. Lieutenant General Bob Williams (Retired) lives a block down the street from us. He recently let me read a copy of *CONARC History of Army Aviation, 1950-1960*. It had nothing in it about the switch from L wings, nothing on Army

Aviation research and development efforts, almost nothing on Ordnance Corps maintenance and supply support or aviation funding for Army Aviation after the Air Force split separately. (Transportation Corps got into the act with the cargo helicopter in 1951. When the Ordnance Corps wanted to get rid of its problems with Army Aviation funding, maintenance and supply, etc., Transportation Corps gladly picked them up in 1952.)

Whoever wrote the CONARC history took almost all of his information from a search of letters and studies in the G3 archives. So far as real Army Aviation history was concerned, it had very little. There was nothing about the ordnance maintenance teams we organized, trained and sent to Korea; nor the MASH helicopter detachments; nor the provisional division Army Aviation companies we organized in Korea patterned after our AFF Board No. 1 study. There was very little on the initial arming of light, fixed-wing aircraft, which later developed into armed helicopters to dodge Air Force objections, etc., etc.

Oh well, as General Williams says (in jest), "History is a bunch of stories, tales and lies agreed upon by the writers," or something like that.

Check out the L Pilot wings subject with your own museum.

Also, Army Aviation is about 90 percent helicopters and 10 percent fixed wing. How did we manage to get stuck with an old, secondhand branch insignia of the wings and propeller? The insignia implies or hints that we grew out of the Air Corps/Forces! Why not a hot air balloon insignia? Just an idea!

Another subject—From the back cover of your magazine, I note that the helicopter championship team is still using the patch I came up with for the Poland 1981 competition; that was the first competition we won. I was team manager.

COL John W. Oswalt
U.S. Army (Retired)
Ft. Worth, TX

CW4 Harry W. Sweezy, author of "Eagles, Wings and Other Things," reviewed the comments of COL Oswalt and provided the following information:

The article was not written as a history of Army Aviation. It was written to show the roots of the current aviator wings and collar insignia worn by warrant officers.

The evolution of the aviator badge was summarized and did not include all other variations such as balloon pilot, airship pilot, glider pilot or liaison pilot. The evolution showed only the major changes to the common style pilot badge.

COL Oswalt is correct with what he states; however, he appears concerned with the fact that he also read the *CONARC History of Army Aviation, 1950-1960*, and it did not contain information that he thought it should.

COL Oswalt also appears concerned that Army Aviation adopted the Army Air Corps insignia when, in fact, it did not. The article "Eagles, Wings and Other Things" shows that the current design of the Aviation Branch insignia predates the Army Air Corps. As a result the Aviation Branch insignia has roots that truly belong to the Army and the Aviation Branch.

Editor:

Hurray to CPT John G. Kershaw and his article "III/V Platoon Leader's Lessons Learned" [November/December *Aviation Digest*]. I found that a positive attitude and aggressiveness are the keys to successful support platoon leadership. Contrary to popular belief, it is a challenging and rewarding position.

CPT Paul M. Steele
Ft. Belvoir, VA

Editor:

These comments are in regards to the article "Mobility Differential" by Major Lloyd W. Carr, in the November/December 1989 issue of *Aviation Digest*. Although I agreed with a majority of this article's content and enjoyed the reading, there were two specific items mentioned that rubbed me the wrong way.

The first item was calling Army Aviation the founder of a third dimension of the battlefield. This is the last thing that we should want our own branch or any other branch to think true! The only members of Army Aviation in the third dimension should be special electronic mission aircraft (SEMA) and nontactical fixed-wing aircraft well to the rear of operations.

The best chance for our tactical aircraft to survive in a medium or high threat environment is to think in only two dimensions. We MUST use the terrain in order to live and fight again another day. An attack helicopter should be thought of as an armor killing machine that is unrestricted by natural obstacles such as rivers and dense forests while at the same time confined to that very same terrain in order to survive. As soon as we leave the cover and concealment of the earth and venture into the third dimension, our vulnerability increases dramatically. The same can be said for assault helicopter operations. Although they do vastly increase mobility and decrease reaction

time, they are still confined to the terrain for survival.

Army Aviation does not add a third dimension to the battlefield, but it most certainly expands the existing dimensions of the Army's battlefield in both width and particularly depth. We add, for the ARFOR [Army forces] commander, the capability of striking the enemy from one lateral boundary to the other and deep in his rear faster than ever before.

The second point mentioned in this article that I disagree with was the statement ". . .that most officers do not have the 'foggiest idea' what tactics are." What Major Carr might have meant to say was that most aviation officers do not know tactics. Even then, I would tend to somewhat disagree. Whose fault is that, anyway? Tactics are taught in the classroom right there at Ft. Rucker in the officer basic and advanced courses. Applying these basic tactical fundamentals, refining them and reinforcing what was taught in the classroom is the responsibility of battalion commanders and battalion S3s in field units. These field grade officers should be the real experts. Having attended the Armor Advanced Course as an aviator, I know that Ft. Knox graduates are taught offensive, defensive and cavalry tactics extensively. As a former DCAT instructor in attack helicopter and cavalry operations at Ft. Rucker, I can also say that maybe the Army Aviation School should increase not only the number of hours spent on teaching tactics but also the complexity of the subject matter, particularly at the advanced course level. I am very proud of being a member of the Aviation Branch and want nothing less than its officers to be as tactically capable and proficient as those of the other combat arms.

CPT Steven M. Greenberg
Plans Officer
1st Battlefield Coordination Det.
Ft. Bragg, NC

Editor:

The Army ROTC Department at the University of Cincinnati is establishing an alumni association. Our alumni association will seek to support the corps of cadets through affiliation with previous members and recognition of their deeds and accomplishments.

Alumni of the University of Cincinnati Army ROTC program are invited to send their name, address and telephone number to: Army ROTC, ML-44, University of Cincinnati, OH 45221-0044 or call Cadet Captain Terrence Brandt or me at 513-556-3660.

CPT Daniel D. Graff
Assistant Professor
of Military Science
University of Cincinnati

Editor:

Any year group 81 officer who has not yet completed the 9-week Phase II of the Combined Arms and Services Staff School (CAS^3) at Ft. Leavenworth must do so by the end of fiscal year (FY) 1990. Failure to attend may jeopardize promotion and staff college selection. FY 1990 classes also are open to captains in year groups 82 and later who have completed the advanced course and Phase I of CAS^3. For report dates refer to the Army Training Requirement and Resource System computer network, or call the CAS^3 Operations Office at AUTOVON 552-2113 or 2602.

Captains must report to the Ft. Leavenworth billeting office in Hoge Barracks by 1200 on their report date, 1 day before the class start date. Captains must bring a copy of their CAS^3 Phase I completion certificate. The School of Corresponding Studies no longer accepts hand-delivered Phase I material for scoring. Captains reporting for Phase II without a Phase I completion certificate in their possession will not be enrolled.

The Combined Arms Center commander and Command and General Staff College (CGSOC) commandant have initiated two changes that impact on your planning for CAS^3 completion. First, enrollment in Phase I is now automatic upon graduation from the advanced course. Captains have 2 years following advanced course graduation to complete Phase I, the nonresident phase. Second, CAS^3 graduation is a prerequisite to enrolling in the CGSOC nonresident course. Watch for these and other changes in DA Pam 600-3, *Commissioned Officer Professional Development and Utilization*, as mandatory CAS^3 attendance becomes institutionalized in the officer professional development and selection policies.

Questions can be directed to the senior aviation representative on the CAS^3 faculty, COL Ronnie Gipson, at AUTOVON 552-2639/5257, extension 20.

LTC John E. McNett
Operations Officer
U.S. Army Command and
General Staff College
Ft. Leavenworth, KS

Readers can obtain copies of material printed in any issue by writing to: Editor, U.S. Army Aviation Digest, P.O. Box 699, Fort Rucker, AL 36362-5042.

Fire by Friction

When was the last time anyone started a fire with the friction method called "fire thong"? Unless one has a pile of rattan in the survival kit, one is probably out of luck. However, there is another method.

Stories have been written about the Japanese who spent years in the jungles refusing to believe World War II had ended. They lit fires every day without matches. If the sun were shining, they used the bottom of a bottle as a magnifying glass. During rain, however, they found an even simpler way of managing. They opened rifle cartridges and mixed the powder with paper, dry leaves and wood shavings. Then someone could rub a wire along a piece of hardwood until the wood was hot enough for tinder.

Aircrews may also use these same materials. If they do, they should wear gloves because wires get too hot. They may wish to experiment with different gauged wires, such as piano wire or 14-gauge wire hangers. However, snare wire is too soft even when doubled or tripled.

Aircrews without a weapon or ammunition can experiment with other tinders. A wire that works for this purpose could also have other uses in a survival situation. Such a wire would make an excellent addition to a soldier's survival kit.

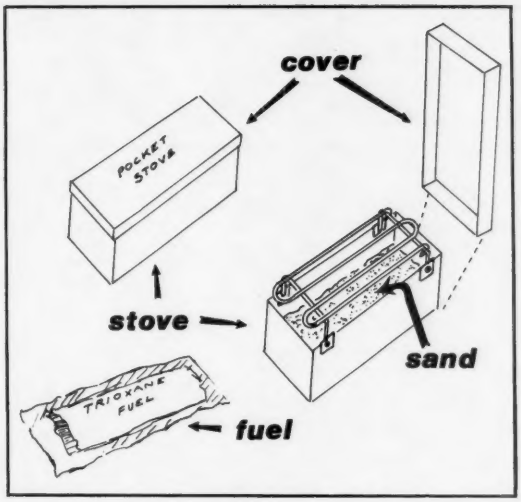
These items in a survival vest and kit make fire starting easier: fire starter, spark lite, national stock number (NSN) 1680-01-233-0061; fire starter, aviation survival, magnesium, NSN 1680-01-160-5618; or matches, nonsafety in round plastic container, NSN 1680-01-154-7199.

Ration Cans

Whoever uses the aluminum general purpose ration can for cooking probably notices that the white lining comes off and floats in the soup. The can was tested at an aerospace medical research laboratory. Here are the results and safety recommendations of that test.

The coating that flakes inside normally represents more of an aesthetic than a health problem. A health hazard may occur, however, when a soldier heats the can excessively. To prevent thermal degradation of the interior coating and possible formation of toxins, no individual should expose the can directly to open flame. Instead, one should heat the can only while warming food or water to limit temperatures under 100 degrees centigrade. Heating or using an empty can for frying may elevate temperature more than 230 degrees centigrade. Such temperatures degrade the lining and produce toxins.

New survival ration cans will soon incorporate a tin-plate coating to eliminate the flaking. Until that time, field personnel should not excessively heat presently used survival cans.



Pocket Stove

The pocket stove, NSN 7310-00-234-3524, is in the supply system with a 2-hour trioxane fuel reserve. This stainless steel stove has a cover that doubles as a wind screen. The base unit has a grid that a soldier can pull out and lock in the up position to hold a canteen cup or other cooking utensil.

If necessary, a soldier can place sand or dirt in the bottom container and then add aircraft fuel to burn when the trioxane is depleted. As with any other flammable liquid, soldiers should be cautious when they use aircraft fuel. They should make sure they do not overfuel. They should add just enough fuel to moisten but not flood the sand or dirt. "Mud pies" in this case are dangerous.

If you have a question about personal equipment or rescue/survival gear, write PEARL'S AMC Product Management Office, ATTN: AMCPM-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 or call AUTOVON 693-3573 or Commercial 314-263-3573.

U.S. Army Class A Aviation Flight Mishaps

	Number	Flying Hours	Rate	Army Fatalities	Total Cost (in millions)
FY 89 (through 31 March)	14	749,482	1.87	11	$42.7
FY 90 (through 31 March)	18	775,248*	2.32	23	$60.0

*estimated

AVIATION MEDICINE REPORT
Office of the Aviation Medicine Consultant

Modular Medicine

Health Services Support in the AirLand Battle

Captain James R. Boen
Medical Service Corps
U.S. Army Aviation Officer Advanced Course 89-3
U.S. Army Aviation Center
Fort Rucker, AL

THE MODERN battlefield will be an area of mass confusion. The lethality of today's weaponry has reached tremendous proportions. Only teams of highly trained professionals will be able to function, survive and help others survive. However, this is how modular medicine will help.

The modular medical system is the base for health services support in medical force 2000. This system evolved because Army medical department (AMEDD) personnel saw a need to standardize all medical units below corps level. The modular design enables the medical planner to quickly tailor, augment, reinforce or reconstitute the battlefield where critically needed.

The system is built around six basic modules. These modules are oriented toward casualty assessment/collection, evacuation, treatment and initial emergency surgery. They exist from the maneuver battalion to the communications zone (COMMZ).

The *combat medic module* consists of the combat medical specialists and their prescribed load of supplies and equipment. This module, normally under the operational control of individual maneuver companies, is sometimes under the medical platoon/section of a combat battalion. These soldiers give initial emergency medical care along with the combat-lifesaver and individual soldier.

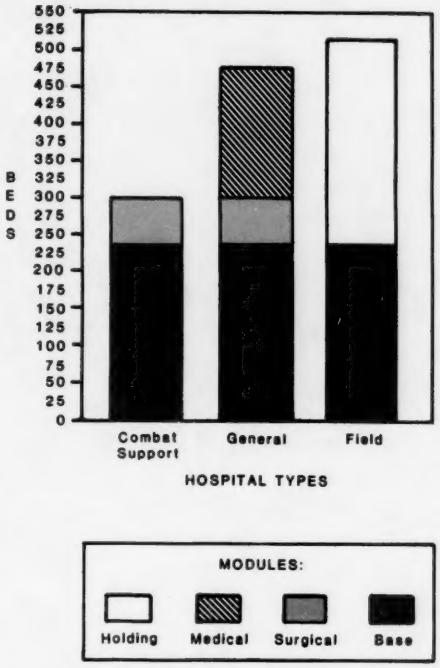
The *ambulance squad module* comprises two medical noncommissioned officers (NCOs), two medical specialists and two ambulances. They evacuate patients and assure them of continual care en route. Ambulance squads, located at every level of the corps and COMMZ, are organic to maneuver battalions. These squads operate in wheeled or tracked vehicles.

The *treatment squad module* consists of a physician, physician's assistant, two medical NCOs and four medical specialists. This squad is trained and equipped to provide advanced trauma treatment to the battlefield casualty. This is the first place in the medical chain where one finds a physician. These squads, organic to maneuver battalions, exist throughout the entire theater of operation.

The *area support squad module* consists of a dental officer, dental specialist, X-ray specialist and laboratory specialist. The dental officer provides emergency and routine dental care. This person, trained in advanced trauma medicine, can provide additional capabilities during peak patient loads. These squads are organic to medical companies of separate brigades, divisions and echelons above division units.

The *patient-holding squad module* comprises two practical nurses and two medical specialists. This module can hold and provide minimal care for as many as 40 patients who will return to duty. These squads are organic to the medical companies of separate brigades, divisions and corps.

The final module is the *medical detachment, surgical.* It consists of a general surgeon, an orthopedic surgeon, two nurse anesthetists, two operating room specialists, a medical/surgical nurse and two practical nurses. This squad



performs early resuscitative surgery on seriously wounded soldiers. Surgical detachments are normally employed in the division support area, but may be employed in the brigade support area during brigade operations. Corps-level surgical detachments augment divisions and corps hospitals.

These modular squads make up the health care units of the division and corps. Matching these squads with the unit missions form functional medical units. For instance, a treatment squad, combat medic module and two ambulance squads make up a medical platoon found in the maneuver battalions.

All of the squads carry their required equipment and personnel in organic vehicles. Additionally, each squad can divide into two fully equipped teams. The teams provide the maneuver commander with highly mobile and responsive medical support.

Forming squads into modules facilitates reconstitution. For example, if a squad is rendered combat ineffective, the next higher level is responsible for replacements. This type of responsibility furnishes combat units with continual medical care.

Hospitalization also falls into a modular system. The corps and COMMZ area comprise four hospitals: Combat Support, Field, General and Mobile Army Surgical Hospital (MASH). The MASH is the only one without a module.

The hospitals include combinations of the base, surgical, medical and holding hospital unit modules. Each hospital starts with a base hospital unit. Depending on the type of hospital, other units are added. These units quickly augment existing hospitals or rapidly regenerate ineffective hospitals (see figure at left).

The MASH furnishes lifesaving surgical and medical care. The MASH may augment existing surgical facilities but will likely be employed forward to support a certain area of operation. This type of hospital is 100-percent mobile and can airdrop to support airborne/air assault operations. Because of its specific mission, only a MASH can reconstitute another MASH; therefore, it does not follow the modular system.

Patient evacuation is key to the success of all medical support. The AMEDD uses the evacuation battalion to help with patient evacuation. The evacuation battalion's mission is to provide command and control of air and ground evacuation assets within an area of operation. Assigned to the evacuation battalion are medical companies consisting of either air or ground ambulances or both. These companies offer additional evacuation support to the organic division and corps medical units. These assets pre-position forward to facilitate more timely evacuation of battlefield casualties.

The modular medical system is approved for fielding, and some units have been fielded in certain commands. The system provides various functions: more responsive care to the battlefield casualty; quicker evacuation; and a superior means of reinforcing and reconstituting medical units from the COMMZ to the forward line of own troops. The system also helps to tailor medical assets to support the tactical commanders' operations.

The Aviation Medicine Report is a bimonthly report from the Aviation Medicine Consultant of TSG. Please forward subject matter of current aeromedical importance for editorial consideration to U.S. Army Aeromedical Center, ATTN: HSXY-ADJ, Fort Rucker, AL 36362-5333.

Army Engineering Test Pilots

Major Thomas C. Wallace
Engineering Test Pilot
U.S. Army Aviation Engineering Flight Activity
Edwards Air Force Base, CA

THE PERSONNEL bulletin "floats" across your desk. You notice the announcement of the closing date for application to the Army Aviation Engineering Test Pilot Program. A nerve twitches—the one that you always knew was there—the one that says, "I want to be challenged, to do something grand, something glorious."

During the next few days, you ask around to find out what others know about experimental/engineering test pilots; i.e., who are they, what do they really do and what does it take to become one? To your dismay, answers range from some "golden arm" pilot to an aviator with a slide rule for a brain (neither of which is true). So who really are these men and women and what is their mission in this Army of ours?

Army Engineering Test Pilots

Currently, 65 engineering test pilots are on active duty in the Army. They range in rank from chief warrant officer, CW4, to brigadier general. All are graduates of the United States Naval Test Pilot School (USNTPS). Twenty-seven are in positions that are coded to require an experimental test pilot (skill identifier G5 (previously 3P)), for commissioned officers, or J for warrant officers. Almost all of the remaining 38 officers are in other aviation-related research and development (R&D) or materiel ac-

quisition management positions. But who really are these test pilots?

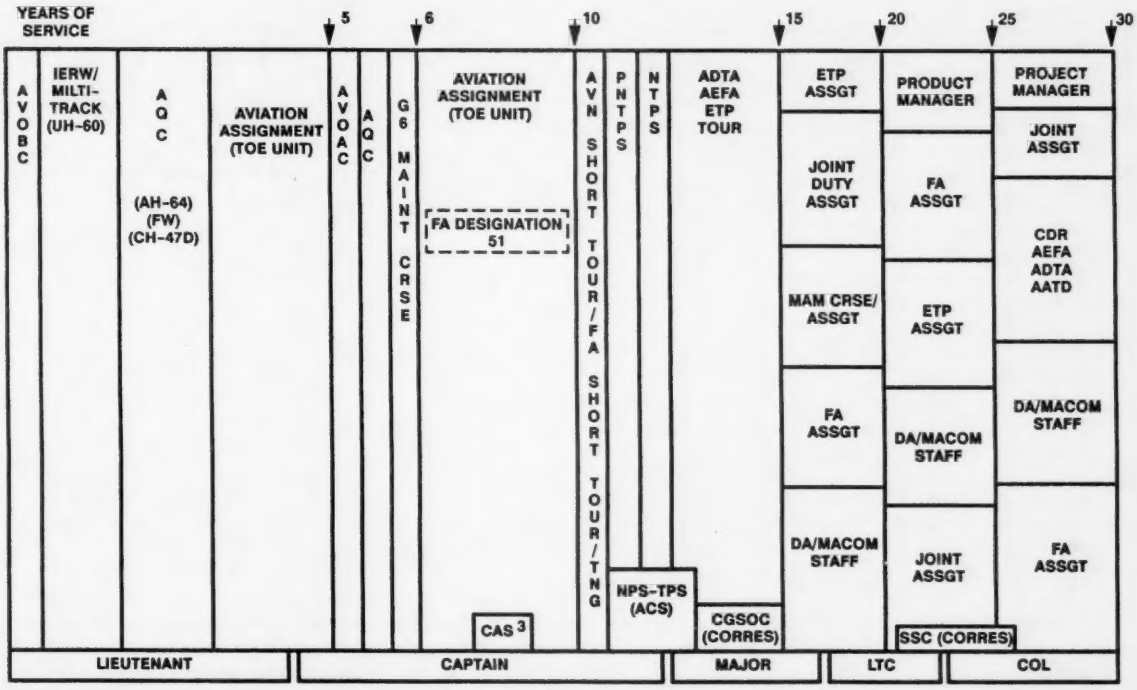
Who they are can be answered best by what they do and where they are assigned. Engineering test pilots are a highly trained corps of pilots who typically work R&D projects. Upon completion of the USNTPS, nearly all test pilots are assigned either to the U.S. Army Engineering Flight Activity (USAEFA), Edwards Air Force Base (AFB), CA, or the U.S. Army Aviation Development Test Activity (USAAVNDTA), Ft. Rucker, AL.

The primary mission of the USAEFA is to plan, conduct and report on airworthiness testing of Army aircraft. To accomplish this, the USAEFA conducts preliminary airworthiness evaluations (PAEs), and airworthiness and flight characteristics (A&FC) evaluations. The PAE is designed to identify airworthiness issues early in the developmental cycle and confirm that an aircraft is safe to fly before flight by other Army organizations. The A&FC is conducted to validate the entire aircraft flight envelope, provide data for operators' manuals and verify that contractual specifications have been met. Typically, engineering test pilots are assigned to specific aircraft programs or special projects as project officers or test pilots.

The primary mission of the USAAVNDTA is to plan, conduct and report on technical tests of all aviation systems. Aircraft, weapon systems, sensors, armament and support equipment, aircraft survivability equipment and testing of foreign material for exploitation are included. Technical testing generally encompasses systems performance and specification compliance, excluding compliance related to vehicle flight performance requirements; reliability; human factors design; safety; and logistical supportability.

The scope of logistical supportability assessment is broad. It includes maintainability and availability parameters; design for maintainability; adequacy of training and technical publications; designated operators and

PROPOSED ENGINEERING TEST PILOT CAREER DEVELOPMENT



Army Engineering Test Pilots

maintainers; supply support; support and test equipment; training devices and transportability.

After an initial tour at USAEFA or USAAVNDTA, engineering test pilots are assigned wherever there is R&D to meet the Army's aviation-related needs. Test pilots are working currently at all levels of the Defense Department's R&D effort. Among current assignments of Army test pilots are aviation system program managers and assistant program managers, National Aeronautics and Space Administration headquarters and centers, joint service projects, strategic defense organizations and other space-related organizations. Test pilots are assigned consistently to positions requiring their highly specialized technical skills and experience.

A target career track for commissioned officers designated as engineering test pilots (identifier G5) is currently being staffed for inclusion in Department of the Army (DA) Pamphlet 600-3, *Commissioned Officer Professional Development and Utilization*. The resulting career track should resemble the one shown in the figure on page 29.

Functional area 51, R&D, is the primary specialty code for most engineering test pilot positions and the code most test pilots carry besides their basic branch code (15). The ideal track begins soon after branch qualification and follows through to the 06 level. Few test pilots have successfully maintained dual proficiency in both aviation (15) and functional area (51).

The decision to enter the engineering test pilot program and pursue a technically oriented career in the R&D functional area should be made with the understanding that it will severely limit the possibilities of commanding an aviation battalion or brigade in the future. Also, promotion potential is less. Check board results for major to lieutenant colonel (LTC) and LTC to colonel for all 51 designated personnel. Conversely, such a decision may lead to future advanced schooling, selection for the Materiel Acquisition Management Program (ASI 6T), challenging assignments working with both government and industry and selection as a product program manager.

Still interested?

The Selection Process

Annually, in February or March, a board is convened to select Army aviators for the Engineering Test Pilot Program and attendance at the USNTPS during the following fiscal year. Classes commence in January and July. DA Circular 351-87-1, *Army Aviation Engineering Test Pilot Training Program*, provides the prerequisites and necessary guidelines for application. In essence, the desired prerequisites are to be dual rated with at least one advanced aircraft qualification, have 1,000 flight hours, an engineering background and be a confident swimmer. The board may waive the dual rating or flight time requirements if warranted by individual circumstances.

In reality, to graduate successfully from USNTPS, you must have a good command of mathematics, including calculus; be comfortable in, and well ahead of, any aircraft you fly; have a good understanding of basic aerodynamics; and definitely be a strong swimmer. Successful completion of a difficult Navy swim test is an absolute requirement before attending USNTPS.

Competition for one of the available slots each year is tough, but you'll never know unless you apply. The board selects the best qualified applicants from the ap-

plications provided by Aviation Branch. The Aviation Branch will not forward applications from officers who are not branch qualified, competitive for promotion or available for a permanent change of station move during the following fiscal year. Individuals who are selected, but do not meet the aircraft qualification requirements, may be sent to transitions en route.

Training

Pre-Naval Test Pilot School Orientation Course. Selected candidates attend an 8-week orientation course at Edwards AFB. Two objectives are met there. First, Army aviators prepare for the USNTPS. Second, USAEFA staff evaluate selectees' flying skills, adaptability and academic proficiency. Students, now commonly referred to as test pilots under instruction (TPUI), receive their first taste of flying and evaluation in unfamiliar aircraft (from OH-58 Kiowa through supersonic fixed-wing trainer).

Some of the academic rigors encountered are math, aerodynamics, mechanics and report writing. The program of instruction (POI) is designed not only to brush up on past learned skills and academic knowledge but to give insight as to what is to come. In addition, TPUIs must attend and successfully complete the Navy swim test including deep water survival training. Historically, Army aviators have had difficulty with water survival training. More Army aviators are eliminated for water survival training than for any other reason. Upon successful completion of the orientation course, students move on to Patuxent River Naval Air Station, MD. Occasionally, an individual does not possess the necessary skills to complete test pilot school. He or she is then reassigned to other duties.

USNTPS. The USNTPS, located on the Patuxent River, is home for the year-long course of instruction. For many, this is the most challenging and rewarding POI ever attended. For most, it means from 16 to 18 long, hard hours 6 or 7 days a week. Three major areas of instruction (academics, flying and report writing) are combined. They build upon each other to provide an impressive and challenging course of instruction.

Academics. About 470 hours of academic instruction are provided to support the flying and report writing requirements. The academics include roughly 100 hours of mathematics with studies from algebra through multiple ordered systems; nearly 100 hours of aviation-related subjects such as propulsion, thermodynamics and human factors engineering; and about 250 hours of subsonic, supersonic and hypersonic aircraft aerodynamics.

A special rotary-wing syllabus containing rotary-wing aerodynamics, performance, and stability and control is provided for the helicopter students. About 20 examinations are provided to help TPUIs gauge their individual progress. Although at first a seemingly impossible academic load, most students do well with hard work, mutual cooperation and assistance from other classmates.

Flying and report writing. TPUIs log between 150 and 200 hours of flight time during the 11-month course. The syllabus calls for about 130 flights, requiring 75 formal postflight briefs and roughly 20 written reports. Most flights are designed to learn and practice flight test techniques or to gather data in support of required reports. Army aviators primarily fly the OH-58 Kiowa, HH-65A Dolphin, UH-60A Black Hawk and U-21A Ute aircraft. Numerous other airframes, ranging from gliders, civil rotorcraft and supersonic fighters to heavy multiengined airplanes are flown for familiarization. The reports prepared from these flights range from a 1-page daily report to a 75-page formal document.

The course culminates with a final exercise that requires the practical application of all skills learned over the preceding 10 months. Each Army aviator conducts a 6 flight-hour technical evaluation of a helicopter not previously flown. Then he or she has 2 weeks to prepare a comprehensive technical report. By graduation, most Army aviators have flown about 30 different aircraft and subscribe to the theory, "If I can start it, I can fly it; and if I can't fly it, it's built wrong."

Most graduates agree that no one thing they did at the school was overly difficult. It was the sheer quantity and broad variety of skills that had to be learned, understood and then put into practice that made the course the ultimate challenge that it was. All agree that it doesn't require a 4,000-hour golden arm instructor pilot with a master's degree in math to be successful. It requires an aviator who is comfortable under pressure, adapts easily to new aircraft, writes coherently, has a working knowledge of calculus and is a team player. Being limited in one area is compensated for by being strong in others.

Deciding to compete for selection as an Army engineering/experimental test pilot should not be done in haste. It is a career decision, a career that truly requires you to "be all you can be." The Army has a real need for qualified junior commissioned and warrant officers who are willing to accept the challenge.

7 a g

THE U.S. ARMY Aviation Branch is only 7 years old, but it may be the oldest 7-year-old around. Maybe it was born in a leap year! That would explain a lot about our experience, wisdom, and knowledge and skills.

Could it be that we take Army Aviation too seriously? Granted, the U.S. Air Force was born as a result of the Army Air Corps, the true forerunner of modern aviation. It is also true that Army Aviation is still struggling for solid recognition and identity.

Perhaps more important, we should recognize that, like many 7-year-olds, we still fall and scrape our knees on occasion—and it hurts. When we knock heads with the people in Armor, Signal, Engineers or Infantry, sometimes we still get a bloody nose. But we aren't backing down and sooner or later we will have our respect. Remember, respectability is the result of credibility. Notice how so many of the words end with a derivative of "ability." That, my friends, is the key.

The birth of the Army Aviation Branch was heralded as a great step forward, but like any infant the steps sometimes were hesitant. As the new kid in the family, there were great expectations accompanying our introduction. We would become perhaps the most important cog in the combat arms team. We would do it all: Shoot, kill, report, transport, all at high speed, day or night, in any weather, anywhere, anytime. I'm not sure, but I think I may have heard a few chuckles. Let's not forget that the birth of the Army Aviation Branch did not give us instant credibility. We are having to earn respect and with it perhaps we are earning the grudging admiration of the other branches—much like the new kid on the block the team captains are reluctant to choose as a member of their team.

Lieutenant General Ellis D. Parker, former commander of the U.S. Army Aviation Center, Ft. Rucker, AL, carried the message and banner of Army Aviation extremely well. And, he assured our continued growth in passing the torch to a young and dynamic leader, Major General Rudolph Ostovich III, the present commander of the Aviation Center. Now, as in the beginning, we are in good hands.

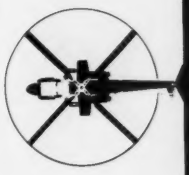
Our growth will come in spurts. That's how kids grow. There will still be those times

nd rowing

Captain T. Cowart
Army National Guard
Multi-Media Branch
Fort Rucker, AL

when we will fall off our bike, but we will get back up and keep going, just like a normal kid. And just like any normal kid, our growth will be accomplished at great expense. It takes a lot of groceries to feed a 7-year-old, and, just like any kid, Army Aviation is consuming a lot of the Army's groceries.

There are other expenses associated with a 7-year-old. How many 7-year-olds do you know that aren't asking for more? Having to compete with older siblings for a limited amount of money for their wants and needs is a way of life. And just like normal kids, the one who proves the most worthy generally gets a bigger allowance. Some folks might argue, saying the one who cries the loudest receives the most attention. That may be, but in the long haul, "a shoulder to the grindstone, let me show you what I can do" attitude will win out over the whiners every time.



How about knocking 'em dead in the World Precision Helicopter Championship with the U.S. Precision Helicopter Team? The team was composed entirely of Active Army and Army National Guard flight crews. The maintenance support was 100 percent Army National Guard. The team captured all the top spots. How about the Army National Guard's flying and maintaining a fleet of aircraft older than most Army aviators? Now that's results!

Soon, maybe not next year or the next, but soon, the Army Aviation Branch will be the offspring that produces the biggest smile and garners the most favor. But, until then, we would be wise to prove our worth. We must continue to learn our lessons well, just like a normal 7-year-old, and take our lumps with dignity.

Even before we earned branch status, Army Aviation was synonymous with being the best and the brightest. Being 7 years old in this business does not give us carte blanche to rush with headlong abandon into the fray. We must learn patience and cunning to grow old and prosper. We can set the example by maintaining high standards and continuing to bring honor to the Army with outstanding achievements. Then, by the time Army Aviation becomes a teenager all the other branches will want us on their team.

FOCUS ON TASN-A

Mr. Tomas A. Berrio

Mr. Tomas A. Berrio is a former maintenance management specialist, Maintenance Management Division, Directorate for Maintenance, AVSCOM.

THE TERM "AIMI," or aviation intensive management item, has been around for some time. AIMI is still a functioning system and an important tool in the intensive management of aviation assets. AIMI is an active program with high-annual-dollar demands and levels of issue negotiated semiannually.

In September 1985, the Department of Defense Instruction (DODI) 4140.54 mandated the military services to implement procedures to permit tracking of parts, components and end items by serial number. To comply with this mandate, the U.S. Army Aviation Systems Command (AVSCOM), St. Louis, MO, implemented, as an adjunct to the AIMI system, a new program known as "AIMI-X," or "AIMI-expanded."

In order that responsible managers may properly manage scarce and high-dollar value items, they must know the item's location and condition all the time.

AIMI-X was designed to provide a means to track selected aircraft items by serial number within the maintenance and supply system. AIMI-X was a Department of the Army (DA) program for serial-number tracking of selected components throughout their life cycle. AIMI-X is replaced by tracking assets with serial number-new designation (TASN-A). TASN-A is an active AVSCOM program by the DA/U.S. Army Materiel Command for serial number tracking. Items tracked under TASN-A may or may not be designated as AIMI items.

TASN-A is the current Army vehicle for serial number tracking of specific aviation components that satisfies the "supply visibility" requirement of the DODI. Serial number tracking under the present TASN-A system is confined to selected aircraft engines and engine modules, main rotor hubs and transmissions. The primary objective of TASN-A is to effectively track the movement, location and condition of these selected components in the logistical system.

TASN-A tracks 171 national stock numbers (NSNs) as follows: 49 NSNs for the prime NSN category and 122 NSNs for the secondary NSN category. The NSN tracking comprises 28 engines and modules, 47 main rotor hubs and 96 transmissions.

The Army Aviation community can better appreciate the scope and magnitude of the TASN-A program after it considers these figures: 49,633 serial-numbered items tracked under TASN-A at an inventory value of $6.6 billion and an average annual 2.2 TASN-A transactions per serial number.

Intrinsic Benefits of TASN-A

TASN-A and its predecessor offered the supply manager at the national inventory control point (NICP) a constant flow of information about the status and health of a given item. Information includes the item's primary identifier, NSN and unique serial number. Considering the many benefits of

TASN-A, the primary benefit to the user is the ability of TASN-A to—

- Use the current supply system to provide issue and shipment data to develop a TASN-A suspense file.
- Allow for automatic followup by the NICP.
- Ensure that the TASN-A manager receives correct and timely reports on all component transactions throughout the life cycle of the item.

In essence, TASN-A is an evolutionary improvement over previous systems in the constant search for better methods to manage the scarce and high-dollar value aviation assets.

Transfer of TASN-A Functional Control

On 3 April 1989, most of the daily functions of TASN-A at AVSCOM were transferred from the Directorate for Materiel Management to the Directorate for Maintenance. This transfer did not change TASN-A policy and procedural guidance previously released to the field by the Directorate for Materiel Management. During the transfer, the Directorate for Maintenance sent a message to the field to stress the necessity for continued reporting through the TASN-A system. Additional formal policy and procedural guidance for the TASN-A program is being prepared for distribution to the field as a future change to AR 710-3, *Asset Transaction Reporting System*, and by an AVSCOM supply letter. Future system procedural changes also will be issued in maintenance letters of instructions.

Future Plans for TASN-A

The Component Management System developed by AVSCOM is one of the most comprehensive programs in the Army. Two major segments of component management are TASN-A and the DA Form 2410 data base. When the two systems are refined and in place, they will complement each other. Then the loop for the umbrella serial number tracking (SNT) system will be complete as mandated by DODI 4140.54. The Directorate for Materiel Management had previously developed a software package partially in use by several activities performing TASN-A transactions.

At the present time, the Directorate for Maintenance is modifying this software package to make it more user friendly. The package should be available to all TASN-A users in the near future. Information on the availability of this software package will be disseminated as soon as development and testing is completed. As a long-range goal, the Directorate for Maintenance has its sights set on the complete automation of the SNT system to create a pure, accurate and up-to-the-minute data base that will enhance Army readiness by improved weapon system availability.

TASN-N Update

A number of positive things about TASN-A have occurred. Here are two examples how TASN-A will work for everyone's advantage.

- During fiscal year 1989, the TASN-A computer program at AVSCOM located and caused the removal of a faulty UH-60 Black Hawk transmission. Had TASN-A not been working at the depot that issued the transmission, AVSCOM could not have tied the transmission serial number to a specific unit requisition number that identified who had received the transmission.

Conclusion: The system worked. Within hours, the faulty transmission was located and removed from service. The correction ruled out a more drastic action such as the release of an AVSCOM safety-of-flight (SOF) message. AVSCOM estimated avoiding more than 4,000 man-hours of time and effort to respond, check and report to the SOF, a definite plus.

- TASN-A test program software is being used by the Aviation Classification and Repair Activity Depot, an Army National Guard facility in Springfield, MO. This activity can spot the duplication of component serial numbers. While the TASN-A manager was making an initial TASN-A asset inventory, the system rejected an AH-1 Cobra main rotor hub serial number. As it turned out, two rotor hubs with the same serial number were found installed on different helicopters.

Conclusion: The problem was easily corrected. Without the correction, confusion would have resulted. Since the item is time managed, such as time between overhaul, several things could have occurred: one of the hubs could easily have been used past its time for change-out or sent in for premature overhaul, or both.

Point of contact for TASN-A is Mr. Ronnie Sammons, AUTOVON 693-1955 or Commercial 314-263-1955, or Commander, U.S. Army Aviation Systems Command, ATTN: AMSAV-MMD (TASN-A), 4300 Goodfellow Blvd., St. Louis, MO 63120-1798.

AVIATION LOGISTICS
U.S. Army Aviation Logistics School

Division Aviation Support Battalion

Mr. James Curtin
Directorate of Combat Developments
U.S. Army Aviation Logistics School
Fort Eustis, VA

IN OCTOBER 1987, the Department of the Army organized and chartered an aviation logistics study group. This group reviewed the Army Aviation logistics systems and determined logistics initiatives to enhance the warfighting capability of Army Aviation.

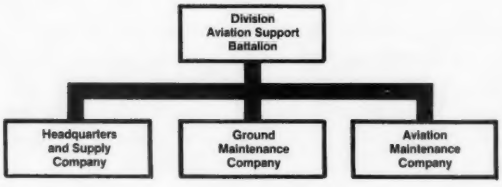
The study group found aviation logistics doctrine inconsistent with and unable to focus support for the aviation brigade. Serious deficiencies existed in combat service support capabilities, particularly in classes III and V (fuel and ammunition).

To correct these deficiencies, the study group recommended the development of a division aviation support battalion (DASB) and a test evaluation to determine the "value added" and if the DASB were affordable. The study proposal was briefed to the Vice Chief of Staff, U.S. Army (VCSA), 19 September 1988 and the Chief of Staff, U.S. Army (CSA), 20 December 1988. The guidance resulting from these briefings was to determine the necessary structure, organizational design and billpayer/claimants and to continue evaluation of the DASB concept.

As a result of this guidance, the U.S. Army Logistics Center (USALOGC), Fort Lee, VA, prepared an interim operational concept (IOC). The proponent schools prepared unit reference sheets that reflect mission, capabilities, assignments, functions, personnel and equipment. The schools prepared these documents for a headquarters and supply company (HSC), a ground maintenance company (GMC) and an aviation maintenance company (AMC) (figure 1). The VCSA briefed and conceptually approved the IOC and DASB unit reference sheets in January 1989.

Personnel resourcing for the DASB will be drawn from the division support command and the aviation brigade in proportion to the

FIGURE 1: Division aviation support battalion.



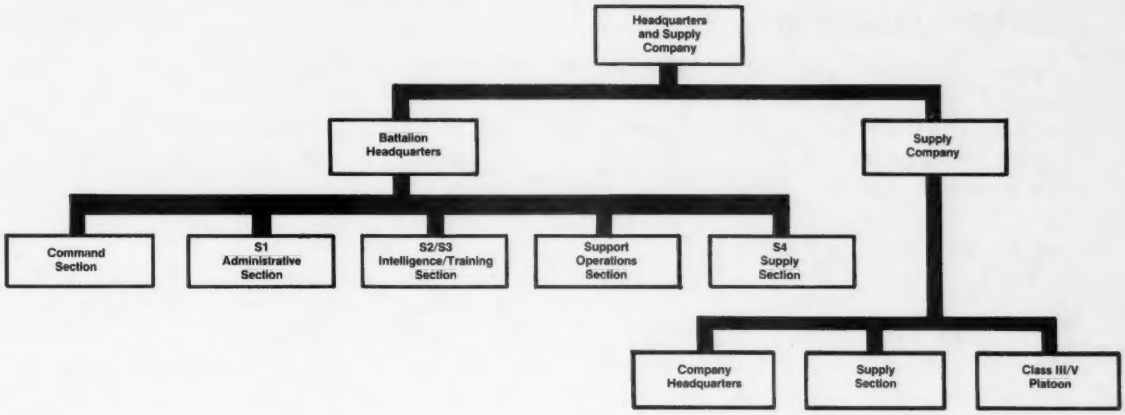


FIGURE 2: Headquarters and supply company.

workload these organizations will transfer to the DASB. Billpaying units should retain essentially the same mission capability as they have now. The DASB will be the aviation brigade's single source of sustainment except for medical, legal, financial, religious, and transportation services and support.

The HSC will provide the DASB with command and control; consolidated feeding; and classes I, II, III, IV, V and VII supply items (figure 2). The HSC will retain a 1-day supply of bulk JP-4, diesel and mogas fuels. The HSC will operate a JP-4 refueling point for the command aviation and assault helicopter companies and a transload site for class III air. Class V operations will be limited to supporting a forwarding support battalion ammunition transfer point (ATP) or the division rear ATP. The HSC is not resourced to operate a DASB ATP.

The ground maintenance company comprises four major elements (figure 3, page 38). Within the headquarters element, the headquarters section is responsible for command and control. The battalion maintenance section will perform consolidated unit maintenance on DASB vehicles and equipment. Also, the battalion maintenance section will maintain the ground-prescribed load list, quick supply store and The Army Maintenance Management System. In the maintenance control element, the maintenance section will conduct technical inspections and quality assurance/control and supervise the cavalry support team. The cavalry support team will perform contact maintenance on track and wheel vehicles, plus tank turret and armament systems. The maintenance platoon element will be tasked with direct support maintenance on track and wheel vehicles, small arms, quartermaster/chemical equipment, power generator equipment, air conditioning equipment and radios.

The class IX element will receive, store, issue and manage repair parts and all class IX

ground and air authorized stockage list (ASL) items for the DASB. These ASLs will be collocated but not mixed. The GMC will not provide maintenance for medical, fire control instruments/computer equipment, communications security, airdrop, avionics, light textiles, aircraft armament and missile and ammunition items. These areas will be handled at division or corps.

The aviation maintenance company will continue its traditional role of providing aviation intermediate maintenance (AVIM) support (figure 4). This support includes aircraft armament and avionics for all divisional aircraft.

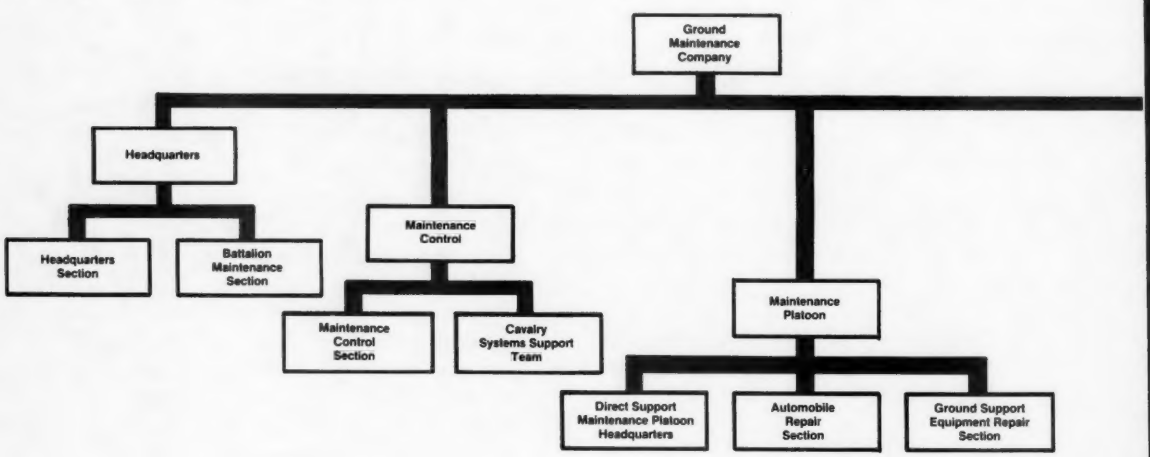
The AMC will also provide backup aircraft recovery and backup aviation unit maintenance (AVUM) support. The most notable difference between this AMC and the current AVIM company design is the absence of the supply and service platoons that transferred to the GMC.

External support for the DASB will, of course, be required. Resupply of classes I, II, III ground (bulk) and IX ground will come from the division main support battalion (MSB) and corps. Corps will resupply class III air (bulk), VII and class IX air, as well as provide backup aircraft maintenance. Backup ground and missile maintenance will come from the MSB.

The forward support battalion (FSB)/division rear ATPs will have the required class V for supply point distribution. Stock from the corps ammunition supply point or corps storage area will be moved by corps transportation to the FSB or division rear ATPs.

Will the division aviation support battalion become a reality? This depends on what happens in Germany. On 10 July 1989, the CSA was briefed on the DASB as part of his Army of Excellence update. The decision to test the DASB concept with a unit in U.S. Army, Europe remains unchanged. The USALOGC completed the development of the test table(s) of organization and equipment in September 1989. The Independent Evaluation Directorate

FIGURE 3: Ground maintenance company.



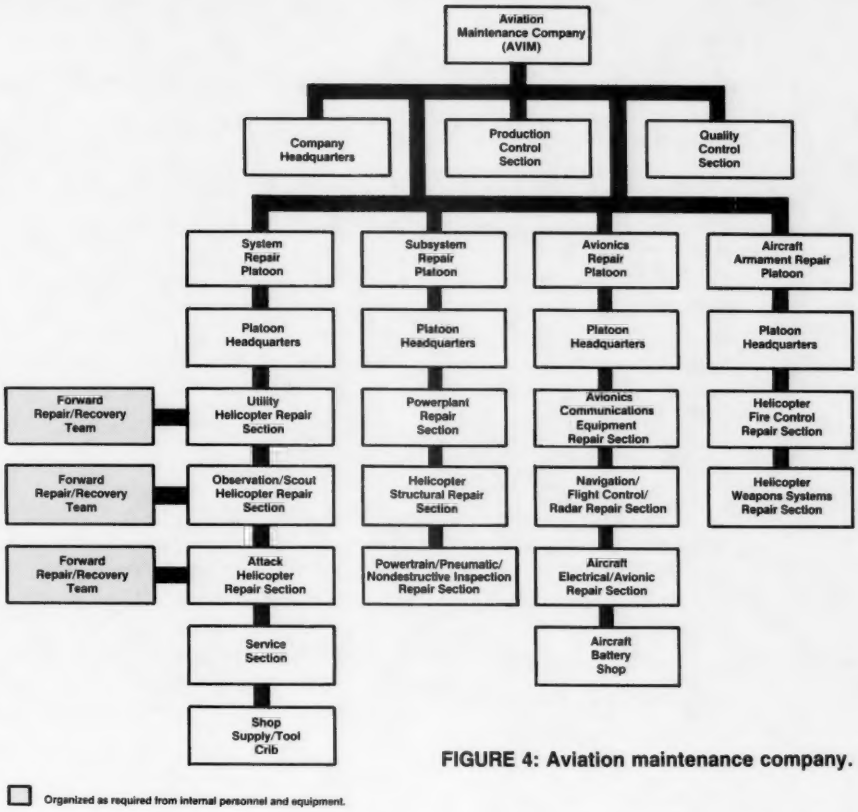
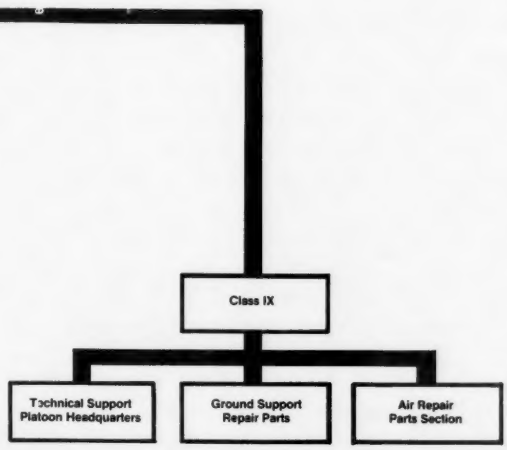


FIGURE 4: Aviation maintenance company.



for the U.S. Army Training and Doctrine Command (TRADOC), Ft. Eustis, VA, is developing an Independent Evaluation Plan for the test. TRADOC will also execute the evaluation. Contingent upon the resolution of personnel "billpayer" issues, shifting people to form the DASB, the evaluation period is tentatively projected to run from May 1990 to May 1991. The Independent Evaluation Report is scheduled to be completed by September 1991.

The point of contact for the DASB is Mr. James Curtin, U.S. Army Aviation Logistics School, AUTOVON 927-6684.

In the aftermath of the devastating California earthquake of 1989, Aviation Support Facility 27 mechanics assisted with MEDEVAC and relief support operations. They developed the "pitstop" or "gang maintenance" approach to minimize aircraft turnaround times.

ALL THAT WE COULD BE

Mr. Charles D. Rhodes
124th U.S. Army Reserve Command
Aviation Support Facility 27
Hamilton Army Airfield, CA

AT THE TOP of San Francisco Bay, on old Hamilton Air Force Base, CA (now Hamilton Army Airfield), lies Aviation Support Facility (ASF) 27. The facility, as we have come to know it, is largely contained in one big, old hangar. We share it, such as it is, with the Active Component aviation assets of Sixth Army Directorate of Plans, Training, Mobilization and Security (DPTMSEC).

The building, abandoned by the Air Force and pressed into service by the Army, is a humble place—cold in the winter, hot in the summer. The floors are exceedingly uneven. When it rains, it rains indoors as well as out. It's not much but, between the 91st Division Aviation Section and the 343d Medical Detachment, we and our seven UH-1 Hueys call it home.

All of the facility's technicians wear two name tags and more hats than I care to think about—not uncommon for dual status Reserve technicians

these days. On 17 October 1989 at 1704 hours, I was upstairs engaged in a planning session with the unit supply/food service noncommissioned officer, who also functions as a Huey crewchief and is our petroleum, oils and lubricants (POL) technician during the week. The opening ceremony for the third World Series game was on the radio down the hall. Ahead of us lay another drill weekend with flights to schedule and meals to get "laid on" for those of us on the ground.

Suddenly, the floor "went four directions at once." It was like being in a fun house at an amusement park—only this was a little scarier. As the rumbling continued to worsen, the fun aspect vanished. Outside, the fire escape beckoned. A quick look at my companion and we decided to leave. Out on the ramp, the last flight of the day had just shut down. The flight crew clung precariously to their Huey as acres of 15-inch thick concrete ramp rose and fell in the long ground swells.

What we didn't know was that about 65 nautical miles to the south, near the town of Santa Cruz, deep within the earth the San Andreas Fault was shifting. In those awful 15 seconds the entire Pacific Plate, including the Santa Cruz Mountains, would move northward 5 feet and gain some 4 feet in altitude. In its wake would come the tragic loss of lives, limbs and property. The San Francisco Bay area would be changed forever.

After we had regrouped according to the facility evacuation plan, our "California calm" set in. Living as we do with the periodic shifting of the earth, we tend to be somewhat cavalier about earthquakes. This one was, however, "healthier" than our usual rumblings. The boss was somewhat concerned about our entering the hangar, with the threat of aftershocks ever present. Quitting time was near anyway, so he decided to call it a day and sent us home to check out our dwellings. This served two purposes. First, it allowed him to check the premises without worrying about injury to his employees. Second, it allayed our concerns about our homes and families.

The radio station in my truck continued with the World Series. Like me, the announcers were unaware of the disaster that had befallen the Bay area. So it was business as usual. The first fragment of information on the quake reached me only after I had pulled into a gas station just outside Hamilton Field. The information came from a Sixth Army member from the other side of the hangar. He had just come off the Cypress Structure en route to Hamilton.

I refueled and headed home. My mind wrestled with the problem of how to fathom a mile-long, double-decker freeway collapse at rush hour. I was numb. Now there was confusion at the ball park and a report of the Bay Bridge collapse. I picked through the radio dial in search of more information and found that some of the stations were off the air. Slowly, as the bits and pieces of news were put on the air, I realized that this might just be the "big one" we had always feared. If it were, things were going to get a lot worse before they got better. The ride home was more cautious than usual as I "eyeballed" each overpass and bridge as I approached them.

Around the bay, San Francisco International Airport, its tower shattered and in shambles, shut down. Oakland's International Airport, the San Francisco counterpart, had large, gaping cracks across its main runway. With both of its main runways cut, Alameda Naval Air Station (NAS) likewise had lost its capability to handle fixed-wing aircraft. To the south, Ft. Ord's Fritche Field began to stagger back to life on generator power. Back in San Francisco, Moffett Field NAS in the south bay and ASF 27's Hamilton Army Airfield in the north were the only operational military airfields left. Of these two, only ASF 27 had a dedicated medical evacuation (MEDEVAC) capability.

As I approached the halfway point on my journey home that evening, the first of our facility personnel were already returning to work. Our maintenance records technician, who is a Reserve Huey crewchief on weekends, was first to arrive back at the facility. He located log books, got the lights on and generally opened things up.

Not far away the two last flight Reserve and Individual Ready Reserve pilots walked into a local pizza parlor and "watering hole" for dinner and to watch the game on their big screen television. The

ASF 27 and UH-1V on the morning of the first day after the earthquake. The UH-1V belongs to the 343d Medical Detachment, which is supported by ASF 27.

picture, however, was not of Candlestick Park but rather that of the Marina District in flames. They stared for a moment, did an about face and returned to the facility. There they linked up with our records technician/crewchief and the 343d Medical Detachment's Active Guard Reserve (AGR) supply sergeant. He is a former Green Beret and was freshly certified as a California emergency medical technician. Together they loaded and preflighted a MEDEVAC Huey. After briefing with Sixth Army flight operations, they launched for Presidio of San Francisco. The time was 1755 hours. Less than an hour had passed since the earthquake had struck.

When the shop foreman returned, he immediately began to take stock of the situation—first, manpower. Two of our mechanics were on temporary duty at Ft. Ord. The maintenance test pilot and one of the other mechanics commute to the South Bay, so they were temporarily out of it. In fact, it was 2 days before they were heard from again. This left him four men short. However, the remaining mechanics were all seasoned veterans, used to working under pressure in hard times.

Next—the aircraft. Statistically, we were in good shape. Only three were in the hangar for maintenance. One needed a night vision goggles modification; the second was in for a minor repair; and the third required only tail rotor hangar assembly inspection/repack to be flyable. A fourth, however, was down at direct support at Ft. Ord. The aircraft's status was questionable at this point as

damage to Directorate of Logistics Maintenance was unknown.

Technical supply was in good shape and likewise POL. Or was it? True, our minifuel farm came through the quake in good working order but, if an aftershock had disrupted electrical power, we would have been like the ancient mariner, "Water, water everywhere, but not a drop to drink." Only in our case it would have been JP-4 aviation fuel, and not a drop to pump!

It took several tries to get through to the home of our POL technician only to find out that he was already en route back to the facility. He had discovered to his chagrin that, in his haste to get home to his family, he had accidentally pocketed the keys to the fuel truck. Other than that, we were "good to go."

Not much later our POL technician arrived on the scene. At the foreman's bidding, he fueled all of our aircraft and bulked both trucks. For the time being at least we were ready.

Several of the facility's mechanics arrived with the POL technician. Those members of the 343d Medical Detachment who lived nearby and could reach Hamilton began to arrive. Most important, among them were pilots and medics.

It was a late night for many of us. For the people of San Francisco, it was a dark one as well. They were without electricity, gas and even telephone service. Not that the phones were out, they were so jammed with traffic that communication beyond one's own immediate c.mmunity was impossible and remained so for several days. This proved to be a headache for us because communication with our homes or members of our respective units was severely hampered or just not possible at all.

By the next morning we had been placed under operational control of Sixth Army DPTMSEC under the direction of their new commander. He was formerly an AGR officer with the 343d Medical Detachment. He was thoroughly familiar with our Reserve facility's assets and capabilities. This added insight served him well over the course of the next few days.

Thanks to the mechanics' work the night before, we had only one helicopter to get out. After a quick briefing by the foreman, we set upon that machine en masse. The severity of the crisis was reflected in an incident that took place that first day. The aircraft that had been left in the hangar from the night before was the one with the half-finished tail rotor hangar inspection and repack. As the repack drew to a close, we began to work to push the ship out as early as possible. The mood was unusually somber; the usual hangar banter was not heard. As a matter of fact, we barely spoke at all. We were all seeing grimly to the task at hand.

I was atop the machine looking over the rotor system and mast. The other mechanics were working on various locations around the aircraft. A small trembler, barely felt, rolled through the area. We all froze in place; no one breathed. Then, our technical inspector broke out in song, "I feel the earth, move, under my feet." Instantly, we all joined in, including accompaniment on the tail boom by one of the mechanics. This bewildered the modification team hard at work on another nearby helicopter. (They were from out of state.)

By 1130 hours the aircraft completed its maintenance operational check and subsequently was released for flight. We were now 100-percent fully mission capable (FMC)!

By close of business the first day, we had begun to get a handle on the turnaround requirements necessary to keep the mission going—enough to satisfy the critical eye of the foreman who released us in rotation to fly as spare crewchiefs on those missions' lacking the third crewmember.

The next morning's brief was simple. We were to break up into teams of two and three and get the aircraft ready for the day's mission...and check everything twice. Throughout that entire period that we were 100-percent FMC, 17 through 31 October, an attitude prevailed that, "good enough was not good enough." On more than one occasion, as the week wore on, sharp words were exchanged between mechanics about techniques used and the best way to accomplish a given task. In all cases, though, safety was uppermost on everyone's mind.

The foreman "snagged" another mechanic and me as we were coming out of the break area and

Two ASF 27 mechanics repair an electrical problem during a daily inspection. The two mechanics are both pilots on weekends; also, one is the 343d maintenance officer and the other is the ASF 27 avionics technician.

sent us to Alameda NAS via an unscheduled maintenance flight. We were to check on one of our helicopters operating from that facility.

The aircraft turned out to be in good working order so we gave it a good preventive maintenance for general principles. The field maintenance we did on that Huey does not stand out in my mind, but rather the flight down and back grabbed my attention.

The devastation of the 880 Freeway and the rest of Oakland was far more impressive than what was seen on television—at least, what we could see from our route of travel. The airspace was restricted above the disaster areas and control was maintained tightly by Oakland Center.

Upon our return, we were happy to hear that contact with our two mechanics at Ft. Ord had been established. Other than being a little worse for wear and somewhat hungry, they were fine. They had spent the night in their motel room without power. Their dinner was a package of peanut butter and cheese crackers by the light of a cigarette lighter. Ft. Ord and the local community were without power for several days; hence, no restaurants or gas stations were operational. The mechanics had not topped off their car upon arrival at Ft. Ord so they were unable to pack up and head for home.

Even if they had had gas, what route could they have used? Virtually every major road through the Bay area had fallen bridges, land slides, buckled overpasses—or were still out of action because of earthquake-related damage of one sort or another.

By noon, Friday, we had pretty well nailed down the quick turnaround business. As one observer put it, "We had some moves that would make an Indianapolis pit crew green with envy."

During one of those pit stops, I noticed something about the flight crews. Not that they were tired, it was something else—something I had seen

in a little fracas I attended in Southeast Asia some years back. Most noticeable was their skin color, or the lack of it. The crews had begun to pale, and their walk had changed ever so slightly—almost as if an invisible weight had been hung on them. Maybe it was a type of forced aging; I don't know. But there was a change noticeable to the keen eye.

Over lunch we found out that our counterpart facility, the 63d Army Reserve Command (ARCOM), Los Alamitos, was sending up half a dozen Hueys to participate in the relief of San Francisco. As we went home that night, I told myself the cavalry had arrived and now the pressure was off. The drill weekend had arrived. After that it would be business almost as usual.

Saturday morning, division headquarters kept our missions to a minimum. About mid-morning a phone call from a Marin-based relief organization got our attention. Someone had promised them a forklift to unload supplies to be airlifted to the Santa Cruz area. The "culprits" were not readily available, so the burden fell to the 91st to provide the forklift and manpower. With the blessing of the commander, we commandeered the facility's forklift and performed a combat assault on the supplies. As we moved the cargo, I noticed the children of Marin were sending their stuffed animals and other toys to the children of quake-damaged areas. We finished up Saturday evening and surveyed the hangar that was filling with goods. I noticed that in the center of the vast pile sat Minnie Mouse next to Snoopy atop some boxes. The famous beagle had his paw around Minnie's shoulder. He looked for all the world as if he were comforting his companion. As it should be, he was dressed as a World War I flying ace. (No foolin'.)

By close of business Sunday night, we had unloaded and collated 10 truckloads of supplies. Then, along with civilian volunteers, we staged and loaded about 100 light aircraft for sorties to the Santa Cruz/Watsonville area. As we drove home Sunday evening, the sun was setting behind the mountains to the west and the traffic was light. I felt we had acquitted ourselves well. We members of the facility had done "good." So "warm and fuzzy," we headed for home, mission accomplished. Well, not quite. Dear old Mother Nature and Fate wanted one more pass with the dice, just for grins.

In the predawn hours of Monday, 23 October 1989, the Bay area was struck by a dramatic storm that brought rain and high winds to confound the rescue efforts of those working to restore some semblance of normalcy.

Upon arrival at work, we immediately climbed into our wet weather gear and headed out to bring in the aircraft. We managed to shoehorn 14 Hueys into the space meant for 10. When the doors were closed, 3 inches of standing water were on the hangar floor. To the amazement of the 63d ARCOM guys, it was still raining inside the hangar. We pointed out the 18-inch gap above the door, then set to work getting the aircraft ready for the missions ahead.

As I reentered the shop area, the foreman confronted me. He stood before me slump shouldered and shook his head in disbelief. The aircraft condition evaluation (ACE) team was here to inspect our aircraft! They were "only" a full 30 days early—not scheduled until the middle of November. I remember one of the crew from the 63d standing, soaked to the skin, in water up to his ankles. With a big smile he said to a couple of inspectors from the ACE team, "Come on in, the water's fine!"

Thanks to a couple of privates first class from the 343d, we finished the inspection in good style, well ahead of schedule. By noon the storm was past and the aircraft were pulled outside again. We squeegeed out the hangar and went back to work, business almost as usual.

The 63d remained another week and were relieved by the 343d, now up to operational strength. The aircraft remained at 100 percent FMC through the end of the month. It didn't rain again and the 343d stood down on 10 November. The rest, as they say, is history.

In the aftermath of the earthquake of 1989, I'm sure there will come a lot of stories—some happy, some sad and some will make us all think about what happened to us during those 7 dizzy days in October. For our part here at the facility, I feel safe in saying we were, in fact, all that we could be.

DES Evaluation Focus

CW4 Mike Wheeler
Flight Standardization Division
Directorate of Evaluation and Standardization
U.S. Army Aviation Center
Fort Rucker, AL

HARDLY A DAY passes at the Directorate of Evaluation and Standardization (DES), U.S. Army Aviation Center, Ft. Rucker, AL, that someone within the Flight Standardization Division doesn't answer a call from the field. These calls concern areas DES looks at during evaluations. This is a legitimate question, one that is easy, but at the same time difficult to answer.

The easy answer is that we will be looking primarily at the Department of the Army (DA) areas of interest for that fiscal year. Then sometimes we must explain these areas. Each year, the chief, Army Aviation Branch, issues to each major Army command (MACOM) a memorandum entitled, "Army Aviation Standardization Program and Areas of Interest." This memorandum is a guide for aviation units and a "marching order" for DES. So on the surface, the question is easy to answer. However, the more difficult answer is a more detailed explanation of these areas.

Because of the many aviation units and missions worldwide, all DA areas may not apply to every unit. These areas include gunnery, units without organizational maintenance and environmental considerations. However, a few "common threads" apply to most units. We need to consider two of those areas: *aircrew training program* (ATP) and *night vision systems* (NVS).

Aircrew Training Program

First, let us consider the unit *aircrew training program* as the first major topic that encompasses three subtopics.

The first subtopic is the **commander's crew qualification program**. Army Regulation (AR) 95-3, *Aviation: General Provisions, Training, Standardization, and Resource Management*, requires that commanders establish in writing a crew qualification and selection program including evaluation methods. Simply put, this means that commanders must develop a program to show how individuals become qualified for each flight crew duty position. The crew qualification selection program must include all authorized crew duty positions. DES still finds units that may have only a pilot in command (PC) qualification program. But all other flight crew positions are left to the imagination. Also, commanders must establish in writing what methods and tasks they will have evaluated for each duty position. Instructor pilots (IPs) determine evaluation methods in some units. Remember, this is the commander's program. The IPs only assist him (they may develop the methods, but the commander must approve them).

Of course, commanders cannot possibly brief every mission that units may fly. Instead, authorized briefing officers do this. So commanders again must establish how they want their flight crews selected for each mission.

What we sometimes find is that flight crews are assigned missions, in some cases, without regard for crew mix (crew experience, weather and com-

plexity of the mission). Crew mix should consider situations as new PCs flying with "older" IPs and visa versa. Or, has either pilot performed the assigned (or a similar) mission? An interesting note is this last item seems to surface time and time again during accident investigations.

A second ATP subtopic to receive attention is the **aircrew mission briefing**. AR 95-1, *Army Aviation: Flight Regulations*, requires a briefing for each mission. An example of a DA Form 5484-R, with mandatory items indicated, is in the back of this regulation. Briefing officers do not give enough attention to detail when they complete the DA Form 5484-R. For example, briefing officers fail to assign crew duties and seat positions; sometimes unauthorized personnel conduct briefings; and PCs or air mission commanders fail to complete the brief back and mission debriefing sections. These easy "housekeeping" errors need only a little extra care to correct.

A third subtopic is the **commander's task list**. Training Circular (TC) 1-210, *Aircrew Training Program Commander's Guide*, states clearly what must be on the task list. But DES continues to find units perform tasks not on the list. Required items sometimes remain off the task list, such as aided and unaided night flying; nuclear, biological and chemical training; and evaluation requirements. Commanders are failing to sign the task list. After a change of command, the new commander should establish a task list or indicate concurrence with the previous commander's list.

Although not necessarily a specific part of the aircrew training program, the designation of mission briefing officers needs mentioning. AR 95-3 states that briefing officers must be in the chain of command down to but no lower than platoon leader. If unit organization necessitates briefing officers from outside the chain of command, then only an 05 or higher may authorize them. All briefing officers must be identified in writing. Commanders 04 and lower have sometimes designated executive officers, section leaders and others outside the chain of command as briefers. Commanders must be careful whom they choose as briefers.

Night Vision Systems

A second major topic of DES evaluations is *night vision systems*. Many organizations do not have all the "directive in nature" messages issued on this complex subject. Units are encouraged to contact their MACOM or the night vision cell within the Aviation Training Brigade, U.S. Army Aviation Center, Ft. Rucker, AUTOVON 558-5858/5812. Then the units can determine if they have all the necessary messages.

Another problem is that unit standing operating procedures fail to cover all the required items in TC 1-204, *Night Flight Techniques and Procedures*. This training circular states what units need for aided and unaided night flight. Required items include routes that separate inbound and outbound traffic and provide for positive air traffic control; supplemental lighting, such as finger and lip lights or taping of cockpit lights; weather criteria; and a vertical helicopter instrument recovery plan.

Night vision goggles (NVG) maintenance causes confusion. The U.S. Army Aviation Systems Command (AVSCOM), St. Louis, MO, Safety of Flight message 280030Z March 1987 established, in part, preventive maintenance checks and services (PMCS) schedules for AN/PVS-5 and AN/AVS-6; proper helmet and AN/PVS-5 face plate modification requirements; and high/low light resolution testing. AVSCOM messages 172225Z and 172369Z March 1989 established distortion testing and disposition of failed systems for all NVG.

During its evaluations, DES finds units either do not complete required PMCS and high/low light testing, do not keep a record of these inspections, or both. Also, units have failed to record the distortion test for each tube of a goggle system. Commanders, instructors and aviators alike need to pay attention to detail to clean up these problem areas.

Although each aviation unit's mission and area of operations is different, the DA areas of interest memorandum will identify the areas DES will evaluate. Units should use this memo as a guide to develop their unit programs and internal preevaluations. If they do, any unit should successfully pass the DES evaluation.

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Fort Rucker, AL 36362-5208; or call us at AUTOVON 558-3504 or Commercial 205-255-3504. After duty hours call Fort Rucker Hotline, AUTOVON 558-6487 or Commercial 205-255-6487 and leave a message.

AVIATION PERSONNEL NOTES

Aviation Career Incentive Pay (ACIP)

The Directorate of Aviation Proponency (DAP), Ft. Rucker, AL, has received numerous inquiries about provisions for the fiscal year (FY) 1990 Defense Authorization Act. The central issue is how the provisions will impact on ACIP (figure 1), the current service obligation and gate system. ACIP uses the provisions of the old Aviation Career Incentive Act (ACIA) of 1974 and the Active Component as a baseline. The ACIP is basically the same for the U.S. Army Reserve (USAR) and the Army National Guard (ARNG).

Total federal officer service (TFOS), aviation service entry date (ASED) and Total Operational Flying Duty Credit (TOFDC) directly influence an aviator's eligibility to receive ACIP. (Refer to the Department of Defense Pay Manual.)

Note: Where mentioned in this article, ASED anniversaries refer to each officer's personal ASED anniversary. The accumulation of TFOS begins on the day an officer is commissioned or appointed as a warrant officer (WO). TFOS accumulates for as long as that person holds the commission/appointment and continues regardless of component (Active Army, Reserve Component, ARNG, Individual Ready Reserve or any combination).

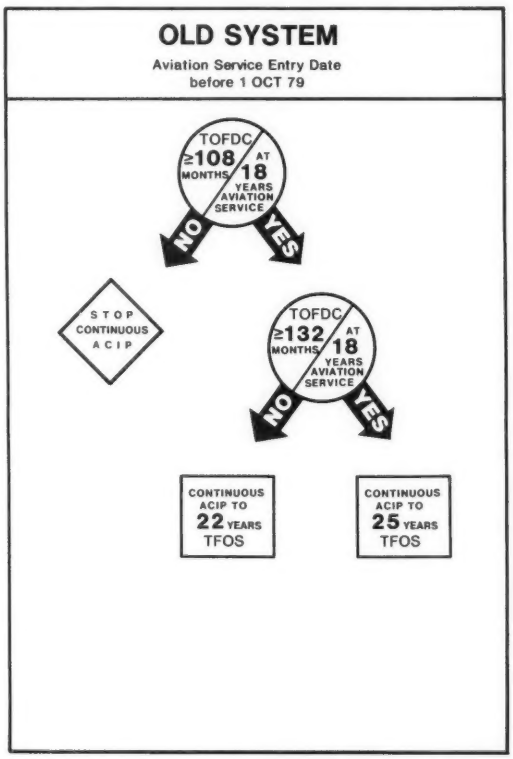
The ASED is the date the aviator enters Army Aviation. For a commissioned officer, this is first day of flight training. For a WO ASED is the day he or she receives the aeronautical rating as an Army aviator. Aviation service continues without interruption until the officer is disqualified or administratively terminated.

The TOFDC is credit awarded for the cumulative number of months of flying. The aviator earns this credit while serving under competent orders in a position coded for flight. For each month the aviator occupies an authorized flight position and remains qualified as an Army aviator, this individual receives 1 month of TOFDC.

Aviation career incentive pay provisions use TFOS, ASED and TOFDC data to determine eligibility for ACIP. Qualified Army aviators, regardless of duty, are entitled to receive continuous ACIP for 12 years after ASED. Qualified is the key word. They must meet as a minimum class II flight physical standards annually.

The 12th anniversary of the aviator's ASED is known as "first gate." The individual's records are reviewed before this date to determine

FIGURE 1



ASED – Aviation Service Entry Date

receive continuous ACIP up through the 18th anniversary of ASED. This is when TOFDC becomes critical.

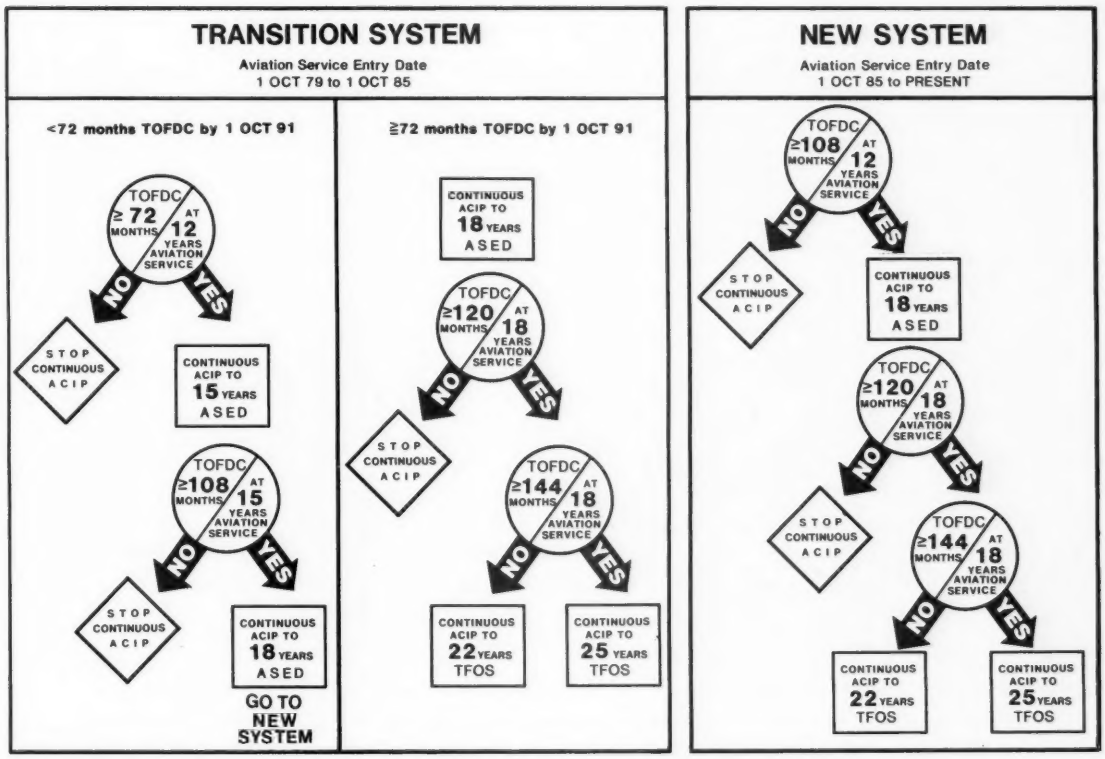
The current ACIA provisions state one must accumulate at least 72 months of TOFDC by the 12th ASED anniversary. This allows that individual to remain eligible to receive continuous ACIP through the 18th ASED anniversary. Without the 72 accumulated months of TOFDC by the 12th ASED anniversary, the aviator enters a fly-for-pay status. Essentially, this means one only receives ACIP when that person serves in a position coded for operational flight and meets the monthly flight duty requirements of a fly-for-pay aviator.

Officers who meet their "first gate" are eligible to receive continuous ACIP through the 18th ASED anniversary as previously stated. The 18th anniversary is known as the "second gate." Records are again reviewed to determine the officer's eligibility to receive ACIP through the 22d or 25th TFOS anniversary.

If an officer has accumulated the minimum of 108 months of TOFDC, that person is eligible to receive continuous ACIP through the 22d TFOS anniversary. If not, that person enters a fly-for-pay status.

With an accumulated 132 months or more of TOFDC, one is eligible to receive continuous ACIP through the 25th TFOS anniversary. There is no third gate.

Gates are met based on the ASED, not TFOS data. The significance is how the gates affect


TRANSITION SYSTEM
Aviation Service Entry Date
1 OCT 79 to 1 OCT 85
<72 months TOFDC by 1 OCT 91
TOFDC ≥ 72 MONTHS AT 12 YEARS AVIATION SERVICE
NO
YES
STOP CONTINUOUS ACIP
CONTINUOUS ACIP TO 15 YEARS ASED
TOFDC ≥108 MONTHS AT 15 YEARS AVIATION SERVICE
NO
YES
STOP CONTINUOUS ACIP
CONTINUOUS ACIP TO 18 YEARS ASED
GO TO NEW SYSTEM
≥72 months TOFDC by 1 OCT 91
CONTINUOUS ACIP TO 18 YEARS ASED
TOFDC ≥120 MONTHS AT 18 YEARS AVIATION SERVICE
NO
YES
STOP CONTINUOUS ACIP
TOFDC ≥144 MONTHS AT 18 YEARS AVIATION SERVICE
NO
YES
CONTINUOUS ACIP TO 22 YEARS TFOS
CONTINUOUS ACIP TO 25 YEARS TFOS
NEW SYSTEM
Aviation Service Entry Date
1 OCT 85 to PRESENT
TOFDC ≥108 MONTHS AT 12 YEARS AVIATION SERVICE
NO
YES
STOP CONTINUOUS ACIP
CONTINUOUS ACIP TO 18 YEARS ASED
TOFDC ≥120 MONTHS AT 18 YEARS AVIATION SERVICE
NO
YES
STOP CONTINUOUS ACIP
TOFDC ≥144 MONTHS AT 18 YEARS AVIATION SERVICE
NO
YES
CONTINUOUS ACIP TO 22 YEARS TFOS
CONTINUOUS ACIP TO 25 YEARS TFOS

ACIP – Aviation Career Incentive Pay **TOFDC** – Total Operational Flying Duty Credit **TFOS** – Total Federal Officer Service

commissioned officers. ACIP for commissioned officers begins to decrease after 18 years of TFOS. The pay chart (figure 2) depicts the old ACIP rate and the FY 1990 Defense Authorization Act revised rate effective 29 November 1989.

FIGURE 2

YEARS OF AVIATION SERVICE	OLD MONTHLY RATE	REVISED RATE
2 or less	$125	No change
Over 2	156	No change
Over 3	188	No change
Over 4	206	No change
Over 6	400	$650

Commissioned Officers Only (TFOS)

Over 18	$370	$585
Over 20	340	495
Over 22	310	385
Over 24	280	385
Over 25	250	No change

Army Aviation Engineering Test Pilot Program

Do you have what it takes to become an Army Aviation engineering test pilot (ETP)? If so, do you know how to apply?

The Army Aviation ETP Program consists of an 11-month course of instruction in rotary-wing flight mechanics divided into academic and flight phases. This instruction is held at the U.S. Naval Test Pilot School, Naval Air Test Center, Patuxent River, MD. The academic portion includes the study of aerothermodynamics, static and dynamic stability, aircraft and engine performance and other selected aeronautical engineering subjects. The flight portions include planning the mission and obtaining engineering data in many fixed- and rotary-wing aircraft. The flight phase also includes preparing technical reports on test data. Classes begin each January and July.

Selection for the highly competitive ETP Program is completed annually by an Officer Personnel Management Directorate Selection Board. The Army has nine quotas a year for attendance at the Naval Test Pilot School and those officers not selected are on standby if qualified.

To apply for the program, one must be a highly skilled aviator with a strong performance record and academic background. Minimum requirements are as follows:

- Be an active duty commissioned officer who is branch qualified and a graduate of the Combined Arms and Services Staff School, or else be a warrant officer aviator in career status.
- Demonstrate performance indicative of continued selection for promotion and in grade of major or below after training.
- Meet medical fitness standards for flying outlined in AR 40-501, *Standards of Medical Fitness*, chapter 4.
- Complete college algebra, calculus and physics with above average grades. A college degree in an engineering discipline is desirable but not required.
- Qualify in both rotary- and fixed-wing aircraft with a minimum of 1,000 hours military flight time.
- Pass the Navy swim qualification test.
- Have at least 4 years of service credited after training before any mandatory release/retirement date. Graduates incur a 4-year service obligation after training.

Additionally, any experience one may have in complex aircraft is highly desirable and could enhance chances for selection. These aircraft include the CH-47 Chinook, UH-60 Black Hawk, AH-64 Apache and OV-1 Mohawk. The board may select eligible officers who are not fixed-wing qualified based on a strong academic background. If so, the board could then program training for these eligible officers to meet the prerequisites. Therefore, no eligible applicant should be discouraged by the stringent flight prerequisites for selection.

Upon graduation, one can expect a 4-year utilization tour as an ETP or in a staff position. The duties would involve decisions affecting the type, design and configuration of Army aircraft. Additionally, that person will be assigned the additional skill identifier 3P if commissioned or the skill qualification identifier J if a warrant.

So, if one has the "right stuff," all that's left to do is apply. Interested officers apply by contacting their personnel assignments officers at the U.S. Total Army Personnel Command (PERSCOM).

They should submit written applications through normal command channels with proper endorsements to Headquarters, Department of the Army, ATTN: TAPC-OPD-D, 200 Stovall Street, Alexandria, VA 22332-0413. Officers may write for application details from PERSCOM, Aviation Plans/Programs, ATTN: TAPC-OPD-D (CPT Thomas), AUTOVON 221-8156, or Commercial 202-325-8156. For more information on this subject, read "Army Engineering Test Pilots," page 28, this issue.

Warrant Officer Flight Training (WOFT) Program Information Booklet

The Army's WOFT Program is the only one of its kind in the armed services. The program, a thorough and challenging course, demands hard work, self-discipline and dedication for one to become an Army Aviation WO. However, the pride that comes with donning the WO bar and aviator wings makes this challenge worthwhile.

Several years ago, the Army accessed about 75 percent of WO candidates (WOCs) through the civilian enlistment option known as the "high school to flight school" program. The remainder (25 percent) were selected inside the military. Today, the WOCs are accessed equally: 50 percent civilian and 50 percent military.

Civilian prospects are recruited for the WOFT Program under an enlistment option. Army Regulation 601-210, *Regular Army and Army Reserve Enlistment Program* (revised in 1987), prescribes the enlistment option procedures for civilians who apply for the WOFT Program.

Enlisted applicants applying from the Active Army, Air Force, Navy, Marine Corps, Coast Guard, ARNG and USAR, on the other hand, must apply under the provisions of AR 611-85, *Selection of Enlisted Volunteers for Training as Aviation Warrant Officers*, dated 15 June 1981. Unfortunately, this reference is not current, making the application procedure more difficult. The U.S. Army Aviation Center, Ft. Rucker, revised AR 611-85, but the Department of the Army has since held up printing it because of lack of printing funds.

The Aviation Center has taken an interim measure to help enlisted personnel apply for the WOFT Program. DAP has designed a booklet, *U.S. Army Warrant Officer Flight Training Program*, to assist potential applicants in many ways: understand the current WOFT Program; provide information on the WO Candidate School; give a broad course overview of initial entry rotary-wing flight training; outline program prerequisites; and provide current application procedures.

Copies were mailed to the following addresses: U.S. Army Recruiting Command to help recruiters present similar programs; aviation brigades for distribution to their lower organizations as a guide; and the ARNG and the USAR to help enlisted soldiers apply for the WOFT Program.

Civilians who write to the Aviation Center to request WOFT Program information receive the booklet in a Ft. Rucker information packet. Other individuals interested in the WOFT Program may receive a copy of the booklet by sending a self-addressed stamped envelope with $1 for third class postage (or a return address and stamp) to Commander, USAAVNC, ATTN: ATZQ-DAP-PO, Ft. Rucker, AL 36362-5036.

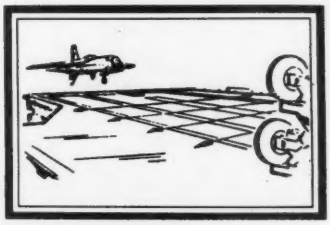
Noncommissioned Officer Logistics Program (NCOLP)

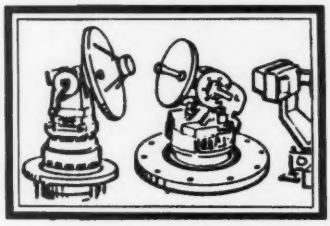
Recent changes to AR 614-200, *Selection of Enlisted Soldiers for Training and Assignments*, chapter 7, now permit all feeder military occupational specialties to 67Z in the pay grades of staff sergeant promotable through sergeant major to receive NCOLP training. The resident course is a 6-week course at Ft. Lee, VA. The many applications have caused a substantial backlog for the resident course. Therefore, interested noncommissioned officers should enroll in the nonresident course. The objective of the NCOLP is to provide the soldier with a broad knowledge of wholesale and field logistics operations. AR 614-200, paragraph 7-18, has the application procedures for the NCOLP membership and schooling. This is an extremely important program for career management field 67 soldiers. Also, this program provides the commander with a distinct logistics combat multiplier to keep the fleet flying. Point of contact is U.S. Army Aviation Logistics School, ATTN: ATSQ-LPN (SFC Hartman), Ft. Eustis, VA 23604-5414, AUTOVON 927-6555/4937.

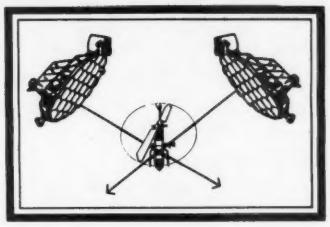
ATC FOCUS
U.S. Army Air Traffic Control Activity

Flight Data Input-Output System

A National Airspace System Plan Building Block for Army ATC Facilities







Master Sergeant Keith A. Ellefson
U.S. Army Air Traffic Control Activity
U.S. Army Aviation Center
Fort Rucker, AL

THE NATIONAL Airspace System Plan (NASP) for facilities, equipment, associated development and other capital needs has information about how to update and improve air traffic control (ATC) and airways facilities. The NASP projects apply now through the year 2000 and beyond for the Federal Aviation Administration (FAA) and Department of Defense (DOD).

DOD must fully participate in the National Airspace System (NAS), not just at the respective DOD airfields and bases. DOD must also provide for an orderly transition from the terminal/en route environment into and out of the special use airspace environment.

The first edition of NASP, published in December 1981, contained 81 NAS projects.

DOD completed an analysis of the NASP in April 1985. The September 1989 edition of the NASP, now available, includes for the first time a chapter on DOD requirements. The new chapter recognizes the role of DOD in ATC as a user and provider.

One of the first NASP projects to come online to directly impact Army ATC facilities is the Flight Data Input/Output (FDIO) project. The FDIO will replace the existing flight data entry and printout (FDEP) systems at FAA and DOD facilities.

The FDEP exchanges flight plan data between the host computer at air route traffic control centers (ARTCCs) and satellite ATC facilities; for example, approach control facilities and ATC towers. The information is passed through dedicated telephone circuits and modems. The FDEP equipment at the satellite end consists of a modem and a flight strip printer(s) with a data-entry keyboard.

The FDIO will continue to use dedicated phone lines and modems for data transmission between ARTCCs and satellite ATC facilities. However, the FDIO will allow much faster exchange of flight plan data between the ARTCC and satellite facilities. The FDIO system will have a remote control unit (RCU) at the satellite end.

The RCU is a small computer that enables the system to do things which the FDEP cannot do; for example, displaying local weather information on the cathode ray tube. This tube will be installed along with new keyboards and flight strip printers. In the FDIO system, each printer will have a discrete address. Each facility will only receive flight plan information of interest to that location.

The FDIO software was initially tested and accepted at the ARTCC, Seattle, WA. As the FDIO software is installed at the other ARTCCs throughout the continental United States, the FDIO equipment at the satellite facilities will be brought online. This installation began in 1989 and will continue through 1990.

In the initial phase for Army facilities, the FDIO system will replace the existing equipment at the Army radar approach control (ARAC) facilities at Ft. Hood, TX, Ft. Rucker, AL, and Ft. Sill, OK. A new FDIO system also will be installed in the ARAC at Ft. Campbell, KY, as a part of this phase.

The next phase planned for Army ATC facilities is providing FDIO terminals at selected facilities. These facilities interface with the NAS and handle instrument flight rules traffic. They include ATC towers, ground controlled approach facilities and airfield flight operations. The plans also include 35 additional Army airfields and associated ATC facilities.

The equipment used for this second phase will be modems and dedicated phone lines between the ARTCC and associated satellite Army facilities. At the Army facilities, small computers will replace the RCUs. A software package that emulates the FDIO software will enable the local processor to interface with the host computer at the ARTCC.

Readers are encouraged to address matters concerning air traffic control to Commander, USAAVNC, ATTN: ATZQ-ATC-MO, Fort Rucker, AL 36362-5265.

illustration by Mark McCandish of General Dynamics

Flying Air Cavalry Missions in the Low-Intensity Conflict

Captain Allen L. Peterson
Commander, A Troop
4th Squadron, 6th Cavalry Regiment
6th Cavalry Brigade (Air Combat)
Fort Hood, TX

FIRST LIGHT. An OH-58 Kiowa and an AH-1 Cobra scout/gun reconnaissance (recon) team (light team) moves nap-of-the-earth (NOE) through the morning mist to the sector where an infantry patrol had been ambushed by communist guerrillas the night before. This is the unit's first mission since arrival incountry 2 days before to help control guerrilla activity. Few soldiers in the unit have been in combat previously, but they are all well trained. The recon is going by the book: NOE flight, masking/unmasking and bounding overwatch. They expect contact.

As they near the operations area, the scout unmasks. Using nearly all available power to climb above the trees, the pilot moves the bird to get a good view of the village where they suspect the enemy is hiding. As he clears the trees, the scout begins taking rounds through the chin bubble as his

observer screams that he has been hit. The pilot tries to break contact, but the bullets seem to be coming from all directions. He just can't get the aircraft moving fast enough to maneuver. As he spins into the trees, the scout hears the gun calling on the radio.

The AH-1 Cobra sees the scout taking fire, but the enemy is too close to the scout to suppress. At his present altitude, the degree of longitudinal dispersion on guns and rockets is so great that he might hit the scout. The gun starts to move forward to assist when he is caught in a crossfire of 14.5 millimeter (mm) guns located on the edge of the village. The pilot attempts to turn out of the fire, but his proximity to the trees, low airspeed, and high-power setting force him into a slow turn. He too is knocked out of the air.

Why did this happen? What went wrong? The team was conducting the operation by the book, doing everything exactly as they had been trained. The problem may lie with the current high-intensity tactics that most every unit trains for. These tactics are likely to fail in the low-intensity environment. Unlike modern mechanized forces, guerrilla forces do not like to move out in the open and terrain normally does not restrict their movements. A company-sized element can easily hide from an aircraft in a heavily vegetated area. Radar-guided missiles and guns are no longer the Army aviator's primary concern. Small arms, optically sighted guns and man-portable missiles are your threat, and you must modify your individual and team flight habits to survive.

What follows is a set of 10 "rules" that hopefully will stimulate discussion among the aircrews of units responsible for the low-intensity mission. The rules and discussions were gathered through research and through interviews with several combat-experienced air cavalry pilots.* All of the ideas presented have been used in the past to a greater or lesser degree of success. They are not all inclusive, nor intended to be taken or used verbatim. Hopefully, they will provide a stimulus for ideas that your unit can use to develop individual and team operational techniques for the low-intensity environment.

*Interviews were held with a wide variety of individuals. The author wishes to acknowledge the contributions of CW4 D.E. Keeney and CW4 James Castillo, cavalry scout and Cobra pilots.

Ten Old Timer Rules To "Live" By

1. ***No area is a safe area. None!***
2. ***Mobility and speed are your greatest assets. Use them.***
3. ***Take no weapon or weapons system for granted.***
4. ***Gun pilots must never lose sight of their scout(s).***
5. ***Pilots must react in a quick, an instinctive and violent manner when being engaged.***
6. ***Never give up trying to evade enemy fire until you are shot down.***
7. ***Do not attack unless you have a definite advantage or the situation dictates that you must.***
8. ***Do not underestimate your enemy's ingenuity or ability.***
9. ***Do not trust the local population.***
10. ***Be innovative. Be flexible. Do not be predictable.***

❶ *No area is a safe area. None!*

Never assume that any area is safe. Just because an area was unoccupied yesterday or this morning does not mean that it is clear now. Treat every area you go into as if it is hostile until you properly clear it. If you leave the area unsecured for any length of time, you must reclear it. The time that you don't properly clear or recheck an area will be the time that an enemy patrol will ambush you.

You must also apply this rule when you are planning your route to and from your area of operations. You basically have two choices for your en route altitude: as low as possible, or above the effective antiaircraft range. If the threat of surface-to-air (SAM) missiles is low and the weather is good, you may want to fly at an appropriate above ground level (AGL) altitude that will keep you clear of ground gun fire. Generally, it is accepted that 1,500 feet AGL will keep you clear of small arms fire; however, you will have to go about 4,600 feet (1,400 meters (m)) AGL for the 14.5 mm ZPU-4 and to about 8,100 feet (2,500 m) AGL for the ZU-23-2 to be completely clear of these systems. (These distances are determined based on the weapons range if you fly directly overhead; logically, the further you are away from the weapon the less vertical range it will have.) On the other hand, if the missile threat or the weather is unacceptable, then you are going to have to fly low and the route you pick becomes critical. In either case, weigh all the factors and, based on mission, enemy, troops, terrain and time (available) (METT-T), choose a proper altitude and route.

❷ *Mobility and speed are your greatest assets. Use them.*

Your hovering aircraft has just entered the infantryman's environment and is an easy target. You are at a disadvantage in the areas of stealth, cover and concealment. Higher airspeeds lower aircraft exposure time and, therefore, reduce the chances of being hit. However, higher airspeeds also decrease observational abilities and reaction time. Based on the factors of METT-T, the pilot in command (PC) must pick the best flight mode to develop the situation fully. Moreover, the PC may have to change the flight mode constantly to develop the situation fully and complete the mission (see figure below).

For example, a light team has been assigned the task of conducting a recon of a village and the surrounding terrain. Upon arrival to the assigned area, the scout begins a series of high-speed, contour passes from various directions with the gun moving as needed to cover the scout. If he doesn't draw fire, the scout can slow his passes progressively. He can continue to slow down until he either completes the recon or takes fire. The key point here is that the scout uses the least exposed mode of flight first and works his way to the best observational mode as the area becomes clear.

If you fly "at altitude" en route to the area of operations (AO), remember that helicopters are vulnerable when descending from altitude to start an operation. Attempt to descend rapidly, using the maximum rate of descent that your aircraft and experience level will permit. Terminate the descent

Different Modes of Flight.

MODE	ADVANTAGE	DISADVANTAGE
Low/Fast	Short exposure time	Poor observation
	Best aircraft performance	Shorter reaction time
Low/Slow	Good observation	Increased exposure time
	Good reaction time	Longer time to break contact
		Poor aircraft performance
High/Fast	Good observation	High exposure
High/Slow	Good observation	Minimum exposure

with forward airspeed to an area where the enemy is least likely to be. You must ensure you are prepared to start the mission before you descend; there will be no time to find yourself on the map or adjust your kneeboard once you enter the high-speed, terrain flight environment.

❸ *Take no weapon or weapons system for granted.*

Even AK-47s have ammunition capable of penetrating armor to some degree. To effectively plan and execute missions, you must know the capabilities and limitations of all the guns and missile systems that the enemy is using. Find out what the enemy is using and determine the best way to lessen his effect. Remember, just because a missile or gun threat exists does not mean that we can't use helicopters effectively. We still use tanks even though antitank missiles exist. We simply have to employ them all the more cunningly.

Optically sighted antiaircraft guns are less effective when shooting at longer ranges and at larger angles. Therefore, scouts/guns should not overfly targets unnecessarily. However, this may not be possible initially when trying to gain enemy contact in dense vegetation. Scouts must identify and mark, if possible, large caliber weapons and attempt to determine the best direction of attack for the gunships. Mark the target in any way possible. Attempt to maintain as much stand-off distance as is possible and still accomplish the mission. As an absolute minimum, keep at least enough distance between yourself and the enemy to be able to evade on foot if the aircraft is shot down.

❹ *Gun pilots must never lose sight of their scout(s).*

The worst thing that can happen to a scout is to take fire and not have the gun know his location. The air mission commander must task one AH-1 Cobra crewmember to always watch the scout. Since the front seat Cobra pilot will probably have to be on the map or in the telescopic sight unit, this job will most likely fall to the backseater. If you do lose contact with the scout, tell him immediately so that he either can climb to a safe altitude or return to a clear area. Once you regain contact the mission can continue.

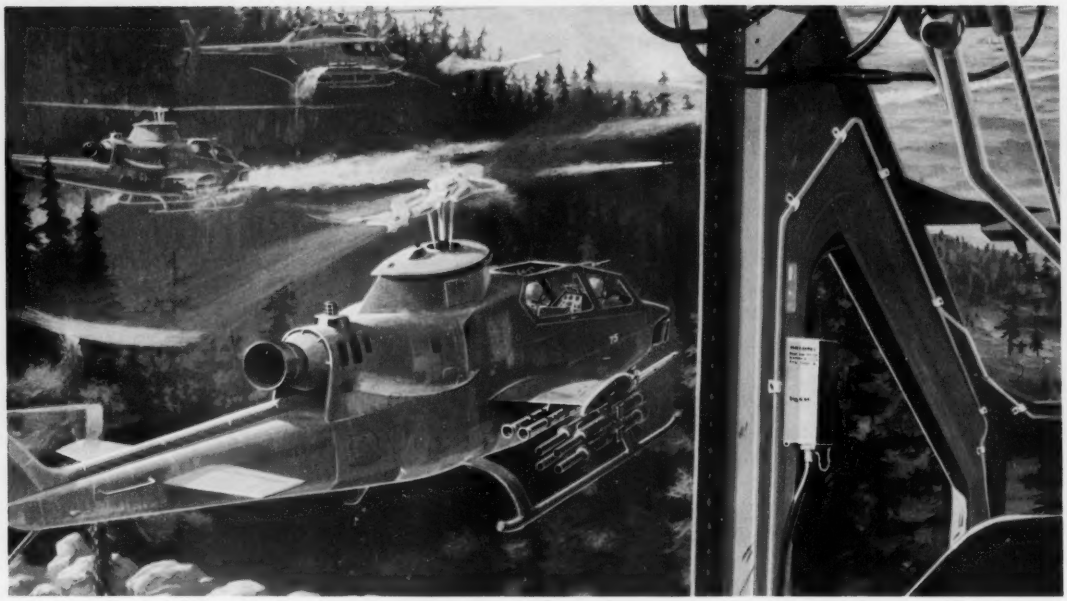
The aircraft, especially the scout, should be marked in a distinctive location with a color contrasting to the surrounding terrain to assist in spotting and tracking the aircraft from above during terrain flight. Possible locations include the dog-house, the tail rotor drive shaft cover, the top half of the tips of the rotor blades, etc. Some may argue that this will allow enemy aircraft to spot the helicopter more readily; however, this should pose little or no problem in the low-intensity environment. Moreover, you can easily paint over the markings if a different level of conflict arises.

When working with more than one gunship during an engagement, they should set up a rotation or "wagon-wheel" so that there is always an inbound ship covering fires. If they organize the rotation properly, the inbound ship will be able to provide cover fire for the breaking ship. There will be continuous or near-continuous fire on the target. This also works at terrain flight altitudes by rotating each gun's period of masking and unmasking.

❺ *Pilots must react in a quick, instinctive and violent manner when being engaged.*

Especially scout pilots! In dense, heavy vegetation, engagements by the scout most likely will be in the range of 25 to 50 meters. This makes immediate evasive maneuvers extremely important. The crew of the scout aircraft must break contact, suppress, talk on the radio and mark the target simultaneously. These actions must become an instinctive crew reaction if they are to survive. If your crews develop these "instincts" during peacetime training rather than learning them in combat, you can save lives. The term violent is used to emphasize the fact that the time to do traffic pattern maneuvers is not when you are being shot at. You must maneuver the aircraft to the extent of its operational limits and to the limits of your abilities.

Scout pilots may want to key the mike, when talking to the gunner or observer, rather than use the intercom system when they suspect enemy contact, so that the other aircraft in the team are



kept advised as to what is occurring. This may allow the Cobra or the second observation helicopter (OH) to preselect weapons and/or position themselves to react to the situation. Common sense must prevail in this situation. Irrelevant cockpit coordination need not be broadcast over the radio. However, information passed to the gunner about the enemy situation may save precious seconds that a second radio call to the Cobra might use up.

Scouts have, in the past, carried a weapons system of some sort in the aircraft. This was usually either a minigun, a crew of two (pilot and M-60 gunner in the right rear seat) or a crew of three (pilot, M-60 gunner in the right rear seat and observer with M-16 in the left front seat). There are many variations to these configurations (M-60 in conjunction with minimum, two M-60s, minigun with observer, etc.) each with its own advantages. The point here is that there is a "real" need for the scout to have some sort of immediate suppression available that is more responsive than a separate aircraft can provide. Why put a soldier on the battlefield with no way for him to protect himself directly or destroy the enemy?

Scout pilots generally should put the objective out the right door of the aircraft. This is important for the following reasons:

- It allows simultaneous observation of the objective by both the pilot in the front and gunner in the rear.
- It also allows the pilot to be able to break left in most cases.
- This enables the gunner to provide some immediate suppression while the pilot is performing evasive maneuvers and calling for fire support.
- A left break is more conducive to keeping the OH-58 within its flight envelope and out of loss of tail rotor effectiveness.

If two low OHs are used, the primary duty of the second OH, following a proper distance behind, should be to suppress for the first aircraft while both are attempting to break contact. When

suppressing to break contact, gunpilots should use the most catastrophic weapon available for the situation first. There is no such thing as saving or conserving ammunition when evading enemy fire.

❻ *Never give up trying to evade enemy fire until you are shot down.*

On the surface this may sound a bit trite, but the point is that the pilot must continue to fly the aircraft and try to break contact until he is either successful or the aircraft ceases to fly. The aircraft may hold together longer than you think possible and enable you to reach a safer position. On the other hand, you need to put a badly damaged aircraft down just as soon as it is reasonably possible. A badly damaged helicopter will probably go from bad to worse in very short time. It would be a tragedy to break contact successfully only to die when your aircraft's transmission fails on the flight home. When breaking contact under fire, monitor your engine and systems instruments as soon as possible to determine the condition of the bird. The observer or copilot can even be doing this as you are breaking contact.

Crewmembers may wish to carry additional weapons, when available, to use when evading from a downed aircraft and/or for marking targets. Crewmembers should ensure that the weapons are as compatible as possible between crewmembers for common use of ammunition.

❼ *Do not attack unless you have a definite advantage or the situation dictates that you must.*

J-series air cavalry troops no longer have the assets to slug it out with every enemy element they encounter. Remember, your primary mission is reconnaissance. A generic light team should only be shooting up the enemy for suppression to destroy lightly armed recon elements or to recover downed aircrews. Any planned attack should include the use of several teams and as many combat multipliers as can be obtained (close air support, ground support, artillery, extra attack assets, etc.) If the combat multipliers are not available and the situation allows some latitude, the team should fall back and maintain contact until the assets become available. Use all available technology in innovative ways to achieve the greatest tactical advantage. This may be the single greatest advantage that we will possess over most low-intensity enemies.

❽ *Do not underestimate your enemy's ingenuity or ability.*

The enemy that you will be fighting probably will have more combat experience than you. Do not fall into thinking that a lesser equipped force cannot conduct effective combat operations. (Look at the Afghans and the Chadians.) Make no mistake; the enemy is out there to kill you, and he will use any weapon or trick that is available. Watch out for tricks and report anything unusual that occurs. For example, if the enemy is engaging you with small arms fire when you are obviously out of range, there is a good chance that he is baiting you in for an ambush by his larger caliber weapons.

❾ *Do not trust the local population.*

In a guerrilla environment, you cannot easily tell who is an innocent civilian and who is the enemy. Therefore, treat all personnel you encounter as potential enemies until they are confirmed as friendly. Coordination with ground units can help greatly in attempting to distinguish between hostiles and friendlies. On the other hand, you should not arbitrarily mistreat the locals that you encounter. This will be a constant problem that the unit is going to have to deal with, and there is no textbook solution.

❿ *Be innovative. Be flexible. Do not be predictable.*

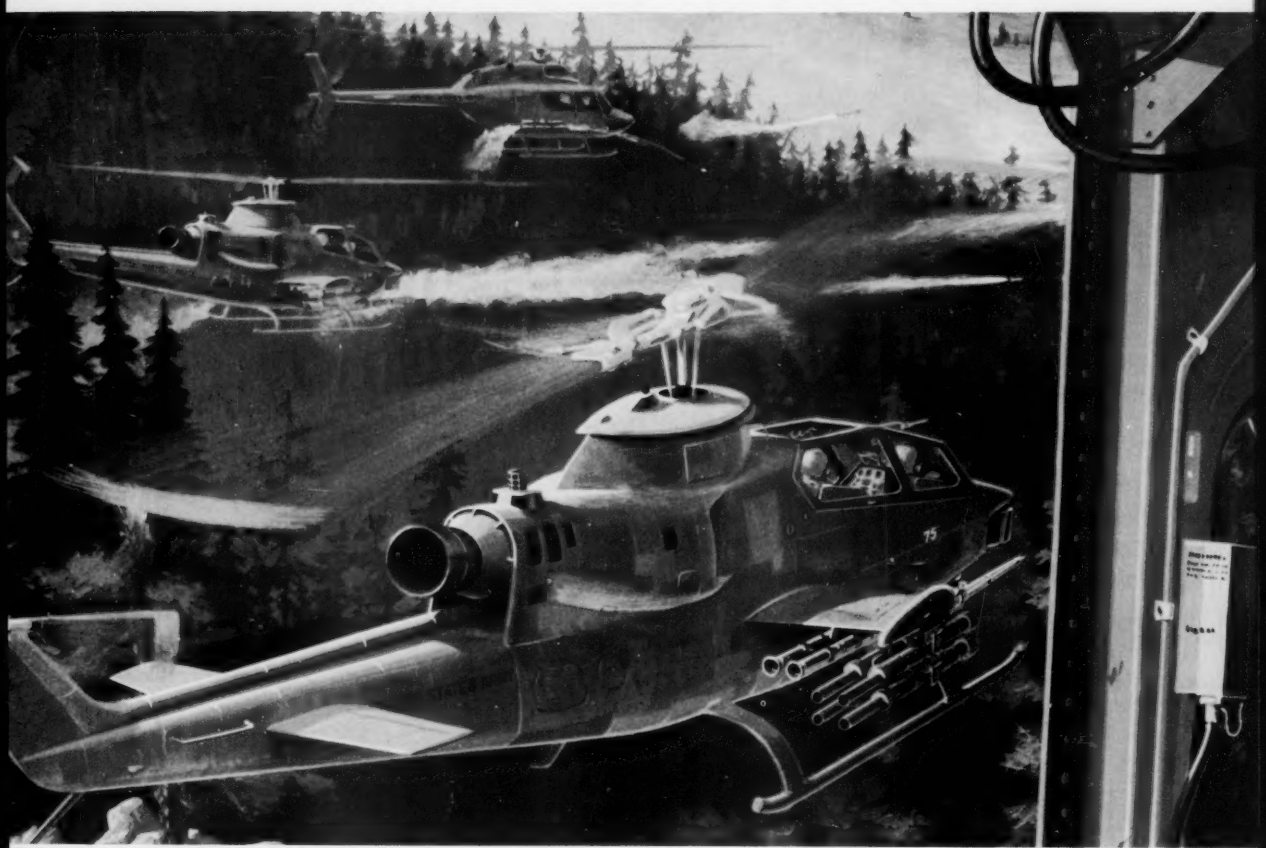
Be prepared to handle a variety of contingencies and be innovative in the ways that you provide support for the ground units. Use all the available aspects of nature to your greatest advantage. The lessons learned in the high-intensity environment should not be forgotten.

Scout aircraft may be called upon to provide command and control for infantry units that are moving through dense terrain and are unable to

observe the enemy. One method that you can use to accomplish this is to set up an orbit so that you pass close enough to the enemy and to the friendly troops to keep both in sight and pass the information on headings and distances to the friendlies. Scouts can accurately observe and adjust "indirect" fire from supported infantry or armor units to include the adjusting of M-60 or .50-caliber tracer rounds, M-203 rounds, hand-thrown fragmentation grenades and main tank rounds.

The troop should organize into mission teams and scramble teams whenever possible. Scramble team crewmembers should learn how to crank their aircraft in minimal time. Preset as many items as possible in the cockpit after preflight and run up; however, operational security always must be taken into consideration.

The normal cavalry light team is ideal for many of the situations encountered in the low-intensity environment. However, teams of three aircraft may be more advantageous under certain situations. When employing teams of three, any configuration that uses more than one attack helicopter aircraft severely limits the number of teams that the troop can field. So, the commander must use OH aircraft to their maximum ability to compensate for the small number of AH aircraft. A few three-ship options to consider are at right. *Note*: The use of these options assumes that some sort of suppression weapon is on the scout.



***Option A:* 2 OH Low.**
1 AH High.

Advantages:
- **More immediate suppression for OH.**
- **Frees the gun from having to watch the scout as closely.**
- **More sets of eyes on the recon.**
- **Gun can orbit higher and wider.**
- **Economical use of AH assets.**

Disadvantages:
- **More crews and aircraft exposed.**
- **Poor if high missile threat.**

***Option B:* 1 OH Low.**
1 OH High.
1 AH High.

Advantages:
- **Better command and control.**
- **Free gun from navigation and radio reporting.**
- **Less aircraft exposed.**
- **Economical use of AH assets.**

Disadvantages:
- **Slower suppression for scout.**
- **Gun must make tighter orbits to maintain contact with scout.**
- **Poor if high missile threat.**

***Option C:* 2 OH Low.**
1 AH Low.

Advantages:
- **More available fire power.**
- **Good immediate suppression.**
- **Gun has greater freedom to maneuver.**
- **Low exposure to surface-to-air missiles.**

Disadvantages:
- **High exposure to ground fire.**
- **Can be some air traffic problems.**

Hopefully, this has raised a few eyebrows and stimulated your thoughts to consider some of the differences that one may encounter while flying in the low-intensity environment as opposed to the traditional high-intensity scenario. As the unit gains experience and situations change, the troop leaders and pilots must have informative discussions to adapt tactics to come up with innovative ways to defeat the enemy. Remember the immortal words of Old Bill, "Yahoo! The Cav is fun!"

Eaglestrike

A Korean/U.S. Combined Aviation Force Operation

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photographs by Rick Fulton

MORE THAN 100 Republic of Korea (ROK) and U.S. Combined Aviation Force (CAF) helicopters recently took part in Operation Eaglestrike. The operation was a combined military training exercise set in a rectangular area in the north central part of the ROK.

Three Eaglestrike airlift task forces, designed to practice interoperability, were involved. ROK and U.S. UH-1 Huey, CH-47D Chinook and UH-60 Black Hawk helicopters provided airlift support for more than 2,000 ROK and U.S. CAF soldiers, their equipment and supplies. Two AH-1 Cobra attack helicopter battalions provided assault force security and landing zone (LZ) protection.

U.S. Army Colonel (COL) John M. Riggs, commander of Eighth Army's 17th Aviation Brigade and maneuver commander of the CAF, was commander of the operation.

The operation took place under a 3,000-foot ceiling early on a cold winter morning. Overnight, the year's first touch of snow had lightly dusted the country from Seoul to the demilitarized zone (DMZ). The white powder on the ground was just enough to starkly silhouette the knife-edged mountain ridges and peaks surrounding the pickup and landing zones.

"I've been in the Army for 12 years," said Chief Warrant Officer 2 (CW2) Hugh Neenan, a

Republic of Korea soldiers prepare to board a U.S. Army CH-47D helicopter as part of a ROK/U.S. combined exercise.

UH-1 pilot assigned to D Company, 1st Battalion, 501st Aviation Regiment, "and this is the most helicopters I've ever seen used in a single operation. I was involved in one a few years ago where more than 90 were flying, but this beats that one for size."

CW2 Neenan spoke as he and the "Whitehorse-29" crew flew their Huey, through steep-walled canyons and over flat, frozen rice paddies, north toward the "no fly" line of the DMZ—the northern boundary of the area of operations. Those onboard Whitehorse-29 included Warrant Officer 1 Brian Dew, copilot; Private First Class Rodney Randall, crewchief; Staff Sergeant Robert Cole; Specialist Jacob Loving; and Korean Augmentation to the U.S. Army Corporal Park Hyun-Joon. The last three, photographers from the U.S. Forces Korea (Training Support Activity-Korea, Yongsan, Seoul), had been assigned to document the action of the operation.

Whitehorse-29 was first into the air above LZ Eagle. They saw the first insertion by American Black Hawks of the ROK Army Infantry platoons assigned to seize the ground and secure the area for follow-on units. The helicopter then climbed up over a steep ridgeline and angled into the valley containing another LZ, this one code-named "Hawk."

Initially, LZ Hawk was quiet—but that changed quickly. As AH-1 helicopter gunships crisscrossed the area, using natural folds of the steep terrain for cover and concealment, a steady, throbbing thunder reverberated from the valley walls. Suddenly, four CH-47 cargo helicopters, each sling-loading a light truck, raced into view in tight formation and descended rapidly. The rotor wash sent massive clouds of rice straw and frozen mud flying into the air.

Then, as the aircraft settled to the earth, soldiers bolted in waves from the rear cargo doors and quickly secured the LZ. Machine-guns and rifles chugged off blanks and provided interlude sounds between the arrival of two more CH-47 flights. Patrols climbed the ridges, and radio telephone operators stood by while their platoon leaders and platoon

A U.S. Army CH-47D helicopter airlifts a Republic of Korea Army vehicle during Operation Eaglestrike.

sergeants directed the tightly organized bedlam.

The ROK soldiers needed only a few minutes to secure the area, bolt sidewalls on their trucks, sling aboard supplies and gear, then depart the LZ—a somewhat hazardous drive along a narrow, rutted trail set high between the rice paddies. After their departure, quiet then returned to the isolated mountain valley.

COL Riggs described the overall complexity of the mission. He pointed out that the primary focus of the exercise was to move forward, under simulated combat conditions, an infantry regiment and an artillery battalion.

"They are being transported some 70 kilometers from pickup zones in the rear to forward LZs," he said. There was a significant cut in movement time from the assembly area to the point of contact because of the use of helicopters. "If they went by road, it might take them 3 or 4 days. By using helicopters, we are talking 3 to 4 hours to get it moving."

COL Riggs pointed out there was a lot more to the mission than simply pick up and delivery of men and supplies. He spoke of the intensive planning and synchronization involved—particularly between the troops on the ground and the gunships that provided escort and LZ protection.

He also pointed out the monumental effort required to sustain the large aviation force. Sustainability functions tested during this exercise included the mandatory refueling of all aircraft involved, and the simulated rearming of the attack helicopters.

Time and again throughout the day, the word "safety" was heard or implied in various conversations. Safety was considered an obvious feature, not only of the command and control procedures being implemented but of all the actual flying and logistics operations underway during the exercise.

"This kind of training is normally done at the battalion level," said COL Riggs. "[It is] good to do a large exercise such as this one every now and then—just to show that we can do it if we ever have to."

*U.S. G.P.O. 1990-731-035:20001

Important Changes To FLIP Terminal

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AN INTERAGENCY task group has developed a single source terminal instrument procedure book. It will contain all U.S. civil instrument approach procedures (IAPs), standard instrument departures (SIDs), standard terminal arrival routes (STARs) and airport diagrams. The 15-volume set, provided by the National Ocean Survey, will be increased to 16 with Alaska becoming the 16th book.

The Defense Mapping Agency (DMA) will acquire and issue these publications to all accounts to replace the Department of Defense 12-volume set. Good news—Army will have all civil IAPs, SIDs, STARs and airport diagrams. Bad news—a complete set requires carrying additional books.

What about the military procedures? Since military procedures by law, except those at joint-use airfields, cannot be placed in the civil books, DMA will publish a five-volume set of military procedures. The military set will contain high and low IAPs, SIDs, STARs and airport diagrams. Good news—DMA will get rid of the U.S. high altitude and U.S. low altitude (volumes A through E) books. Additionally, military looseleaf SIDs will be gone. Bad news—perhaps more books to carry, depending on the mission.

When will all this happen? Implementation is scheduled for December 1990. Hopefully, users will respond to the U.S. Army Aeronautical Services Office's (USAASO) request in time to modify their FLIP (flight information publication) accounts. If users have not heard or done anything about their accounts, they should call USAASO, AUTOVON 284-7773.

DMA is considering the following: use of spiral binding (probably will not happen because of cost) and extension of the publication cycle to 112 days with cumulative change notices every 28 days. USAASO will keep users informed monthly about this transition by publishing changes and progress in the Flight Information Bulletin.

USAASO invites your questions comments and may be contacted at AUTOVON 284-7773.

A CRASH RECIPE

From a tried and proven recipe used many times year after year.

1. **Take one aircraft of any type.**
2. **Add a slightly switched-off pilot.**
3. **Bring gently to a state of fatigue.**
4. **Add a feeling of letdown, frustration or disappointment.**
5. **Stir in a pinch of must-get-homeitis.**
6. **Garnish with a touch of overconfidence.**
7. **Top with a feeling that it only happens to other people.**
8. **Serve in an unexpected place and at a least expected time.**

When completed, the recipe for a crash invariably leaves a feeling of astonishment that such an occurrence could take place.

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